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# FEDERATED MALAY STATES.

# ANNUAL REPORT

OF THE

# MEDICAL DEPARTMENT

FOR THE YEAR

## 1929

BY

DR. CHRISTOPHER J. WILSON,
*Principal Medical Officer, F.M.S.*

KUALA LUMPUR:
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# FEDERATED MALAY STATES.

# ANNUAL REPORT OF THE MEDICAL DEPARTMENT FOR THE YEAR ENDING 31ST DECEMBER, 1929.

## I.—ADMINISTRATION.

### A.—STAFF.

Dr. C. J. Wilson assumed duty as Principal Medical Officer on 21st January.

Dr. A. R. Wellington, Chief Health Officer, and Acting Principal Medical Officer until 20th January, was transferred to Hong Kong, as Director of Medical and Sanitary Services, on 24th January. Dr. A. K. Cosgrave was Acting Chief Health Officer during the rest of the year.

Dr. A. N. Kingsbury, Director of the Institute for Medical Research, returned from leave on 3rd March. Dr. G. V. Allen, who had been Acting Director until that date, was appointed Acting Principal of the College of Medicine, Singapore, on 24th June.

Dr. W. H. Hart was Senior Medical Officer, Perak, throughout the year.

Dr. H. G. Holdbrook returned from leave on 15th September, and resumed duty as Senior Medical Officer, Selangor; Dr. H. R. Dive acted as the Senior Medical Officer of Selangor until that date, when he went on leave.

Dr. A. G. H. Smart was Senior Health Officer, Perak, throughout the year, and Dr. W. O. Pou was Acting Senior Health Officer, Selangor and Pahang.

Dr. D. T. Skeen was Senior Medical Officer, Negri Sembilan, throughout the year.

Dr. W. Young was Acting Senior Medical Officer, Pahang, until 30th July, when Dr. C. E. Cobb was appointed to act in this post.

Dr. E. H. Black returned from leave on 21st August, and resumed duty as Senior Health Officer, Negri Sembilan; Dr. W. J. Moir, who had been Acting Senior Health Officer, was transferred from the Federated Malay States to become Senior Health Officer, Johore, on 1st September.

The authorized establishment of European officers on the time scale and above, with the number of appointments actually filled at the beginning and end of the year, is shown hereunder:

| | Establishment. | January 1st, 1929. | December 31st, 1929. |
|---|---|---|---|
| Medical Division | 68 | 53 | 54 |
| Health Division | 41 | 26 | 26 |
| Research Division | 13 | 11 | 12 |
| Veterinary Division | 7 | 7 | 7 |

During the year proposals were made for defining the status of Senior Medical Officers and Senior Health Officers in such a way that these appointments might be classified in grades, instead of being separate and specific appointments in the different States. These proposals were adopted in the Medical Departments of the Federated Malay States and the Straits Settlements conjointly, after approval by the Secretary of State for the Colonies. Consequently the Senior Medical Officers and Senior Health Officers of the Federated Malay States and the corresponding officers in the Straits Settlements are now grouped in two grades. The classification of the existing posts in the Federated Malay States is thus:

Grade A includes—

- Senior Medical Officer, Perak.
- Senior Medical Officer, Selangor.
- Senior Health Officer, Selangor and Pahang.
- Senior Health Officer, Perak.

Grade B includes—

Senior Medical Officer, Negri Sembilan.
Senior Medical Officer, Pahang.
Senior Health Officer, Negri Sembilan.

Simultaneously with this standardisation of these senior appointments a change was made in the titles of certain of the specialist posts. Instead of one "Senior Surgeon" and two "Chief Surgeons" we now have a "Senior Surgeon" and two "Surgeons"; while the "Specialist, Venereal Diseases" has become "Chief Medical Officer, Social Hygiene".

### B.—LEGISLATION.

The Health Boards Enactment was repealed and re-enacted with certain minor amendments. There was no other new legislation bearing on public health.

### C.—FINANCE.

The total expenditure on the Medical Department was $5,983,185, or £698,038. Of this sum $2,985,104 (£348,262) was incurred under the heading of "Personal Emoluments", $2,831,321 (£330,321) under "Other Charges, Annually Recurrent", and $166,760 (£19,455) was "Special Expenditure".

Of the total expenditure on the department, the Veterinary Branch accounted for $161,543 (£18,847).

In addition to the amount directly expended by the department, the Public Works Department expended $1,081,829 (£126,213) on new buildings for hospitals and other institutions; and Mosquito Destruction Boards expended $686,213 (£80,065).

The revenue of the department amounted to $441,459 (£51,554).

Further details of expenditure and revenue will be found in Table II (page 41).

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## II.—PUBLIC HEALTH.

### GENERAL REMARKS.

The state of the public health of the Federated Malay States, as reflected in the statistics, was comparatively good throughout the year.

The death-rate, calculated on the estimated total population, was 26.37 per mille. This is a lower rate than that estimated for either of the three preceding years, when the figures were 29.22, 32.11 and 29.63. It is, however, higher than the estimated rate for the years 1922 to 1925: the figure for 1925 was 23.60.

The birth-rate for the year, calculated on the estimated total population, was 34.67: this is the highest yet recorded for the country. The estimated birth-rate has been rising steadily year by year, and now shows a remarkable increase over the figure of 19.41 recorded for the year 1911. The average birth-rate for the period 1925-1929 is 25 per cent. above the corresponding figure for the period 1915-1919, while the average rate for the last two years, 1928 and 1929, is 35 per cent. above that figure.

Until the year 1922, the number of deaths recorded in the Federated Malay States exceeded the number of births: in the year 1911 it was more than double, as also in 1918, the year of the influenza epidemic. In 1923 births for the first time exceeded deaths, and with the exception of 1927, when the balance was again on the wrong side, they have since been annually in excess. In 1919 there were 6,320 more deaths than births recorded: in 1929 there were 12,969 more births than deaths.

Vital statistics are set out more fully in the report of the Registrar-General of Births and Deaths (Appendix 2) where will be found statistics of the four States of the Federation, of the larger towns, and of the different races, with figures for previous years for comparison.

Study of these statistics suggests comment on certain features of interest, as follows:

In the Malay population, the number of births was lower than in the previous year; the estimated birth-rate is lower than any recorded during the last ten years, over which period the average annual number of births has been almost exactly 20,000: the figure for 1929 was 20,203.

The death-rate in the Malay population is the lowest on record, 22.24 per mille of the estimated population.

In the Chinese population the number of births and the birth-rate are the highest on record. The number of Chinese births exceeded the number of Malay births, for the first time on record. The Chinese births and the estimated birth-rate for 1929 were both considerably more than double the figures for 1923.

The death-rate among the Chinese was 30.40, as calculated on the estimated population. It was thus the highest of any race.

In the Indian population the number of births exceeded the number of deaths: records of all previous years show an excess of deaths over births, with the exception of the years 1924 and 1925 when the figures were approximately equal.

The death-rate among Indians was 27.61. For the years 1923, 1924 and 1925 a lower rate was recorded, but with the exception of these years the rate for 1929 is the lowest on record, being more than 6 per mille less than 1928, and nearly 10 per mille less than 1927.

Of these three races, Malay, Chinese and Indian, estimated as numbering about 585,000, 545,000 and 415,000, respectively, the Chinese showed the highest birth-rate and death-rate, the Malay the lowest death-rate, and the Indian the lowest birth-rate.

It must always be remembered that these rates are calculated from estimates of the population based on the figures of the census in 1921. The annual rate of increase of the three races since 1921 has been assumed to be equal to an average annual rate of increase obtained from the difference between the census figures of 1911 and 1921. It may well be that this crude estimate is not a close approximation to the actual population in 1929, and the calculated birth and death-rates may be correspondingly incorrect.

## PRINCIPAL DISEASES.

### 1.—Malaria.

The promise of the first six months of the year was fulfilled, and the records for the whole year show that malaria in 1929 was less prevalent than in either of the two previous years. The figures on which an estimate of the comparative prevalence in different years can be attempted are contained in three series of records:

(1) Number of cases of malaria admitted to Government hospitals; in many of these diagnosis was confirmed microscopically;

(2) Number of cases of malaria admitted from estates to estate and Government hospitals;

(3) Number of deaths registered throughout the country under the heading "Malaria (including Fever)".

There are many fallacies in calculations based on these records, and the three series are not independent of each other: all that can be obtained is a rough comparison from year to year. Figures from the records for the last three years are shown hereunder:

| | 1927. | 1928. | 1929. |
|---|---|---|---|
| Admissions to Government hospitals | 48,927 | 49,553 | 35,306 |
| Admissions from estates | 41,458 | 40,803 | 24,818 |
| Registered deaths | 20,736 | 20,053 | 16,968 |

The deduction from these figures is that the wave of malaria, which was evident during 1927 and 1928, is now passing, or has passed. The reduction in the number of cases admitted to Government hospitals is nearly 30 per cent. There can be no reasonable doubt that the decrease in malarial infection was the factor responsible for the improvement in the general death-rate last year.

No figures have been collected to show the monthly incidence of malaria throughout the country generally. Study of the records of admissions of malarial cases to Government hospitals in Negri Sembilan reveals a periodic variation during the year which corresponds almost exactly with monthly averages for that State for the last five years. There was a high peak in May; the admissions during May, June and July were more than half the number of admissions during the other nine months of the year; or, to put it in another way, the average number of cases admitted monthly in May, June and July was more than 50 per cent. in excess of the monthly average for the rest of the year. These figures from Negri Sembilan may or may not be found to correspond with figures for the other States.

Figures indicating the relative incidence of malaria in the different races have not been recorded in previous annual reports. If reliable figures could be obtained, fairly representing the comparative incidence of malaria among Malays, Indians and Chinese, these would be of great value. It is, however, under present conditions, impossible to obtain such figures. The figures set out below are produced for what they are worth; it is not pretended that they show the true relative racial incidence; but they are for many reasons interesting.

MALARIA ADMISSIONS AND DEATHS IN GOVERNMENT HOSPITALS DURING 1929.

| | Indians. | | Chinese. | | Malays. | |
|---|---|---|---|---|---|---|
| | Admissions. | Deaths. | Admissions. | Deaths. | Admissions. | Deaths. |
| Selangor | 6,179 | 242 | 2,081 | 183 | 388 | 3 |
| N. Sembilan | 4,318 | 225 | 2,155 | 175 | 270 | 1 |
| Pahang | 2,412 | 71 | 1,899 | 166 | 251 | 5 |
| Total | 12,909 | 538 | 6,135 | 424 | 909 | 9 |

The number of Indian admissions is more than double the Chinese; but the percentage of deaths to admissions is 6.91 for Chinese, against 4.17 for Indians. The total of Malay admissions is comparatively very small, presumably because Malays make little use of Government hospitals, and the proportion of deaths to admissions is less than one per cent.

Reference to measures for the prevention of malaria will be found elsewhere in this report (Section III: Hygiene and Sanitation). They have been continued on the same lines as those followed during many years in Malaya, that is to say, by direct attack on the breeding places of those few species of anopheline mosquito proved to be potential carriers of the malarial parasite. This method of reducing malaria is considered, by general consent in Malaya, to be the only rational and practically effective form of attack, at least in this country. Conditions in Malaya are peculiarly suited to this direct method, since not only can the urban population be protected, but also the great number of rubber estate labourers and dependants, who are concentrated in compact labour lines. Such labour lines in reality constitute miniature towns for sanitary purposes, and it is possible, with the necessary expenditure, to establish a safety zone around them within which the breeding of dangerous anophelines can be controlled.

The results of this control of anopheline breeding in selected areas have been satisfactory, as shown by the records of many towns and very many estates in Malaya. It has also proved very successful wherever it has been applied to large labour forces engaged in engineering works. A notable example during the past and previous year has been the Perak Hydro-Electric Company's construction camp, where the malarial incidence among the labourers has been remarkably low. The operation of the Health Boards Enactment may show to what extent the method can be effectively extended to the more truly rural population.

In addition to anti-larval measures, great quantities of quinine are distributed freely among the population; but any attempts at general quininization, or at protection against the attack of adult anophelines, appear to be frankly regarded by most authorities in the country as being futile. As for the word "bonification", now so much in vogue elsewhere, it is unwise to mention it.

The research work on malaria, undertaken during the year, is described in the report of the Institute for Medical Research. Investigations were made into the conditions which may influence the infectivity of malarial patients, especially with regard to the effect of treatment with quinine; experiments were made in mosquito trapping with a human bait, and in the breeding of mosquitoes in rice fields.

### 2.—Dysentery.

The general heading of "dysentery" undoubtedly includes a variety of diseases and conditions. In the case of patients admitted to Government hospitals the differentiation between amoebic and bacillary dysentery is attempted; but not much reliance can be placed on the figures recorded. In the report of the Registrar-General of Births and Deaths there is only one category, "Dysentery and Diarrhoea", and this generalization is probably less misleading than any attempted classification.

The total number of deaths registered under the heading of "Dysentery and Diarrhoea" was 2,194, as compared with 2,900 for the previous year, a reduction of 25 per cent. The number of cases admitted to Government hospitals as amoebic, bacillary or undefined dysentery, was 2,457, with 733 deaths; there were 2,234 admissions for diarrhoea with 346 deaths. The total figure for admissions, 4,491, is less than the figure of 6,629 for the previous year, the reduction here also being about 25 per cent. The case mortality in each year was about 22 per cent.

The inference from the records is, therefore, that there was a reduction of 25 per cent. in 1929 as compared with 1928, in the incidence of disease which is recorded under the name of dysentery or diarrhoea.

Figures of the racial incidence of "dysentery" have been collected from three States. They are as under:

| | Admissions. | Deaths. | Mortality. |
|---|---|---|---|
| Indians | 986 | 295 | 29.92 per cent. |
| Chinese | 320 | 125 | 39.06 ,, |
| Malays | 55 | 1 | 1.81 ,, |

### 3.—Smallpox.

Ten cases of smallpox were notified during the year: two were fatal. A small outbreak occurred in and around Kuala Lumpur, the infection having apparently been brought by a passenger on the railway. The energetic measures taken to prevent spread of the disease, by isolation and vaccination, were successful; the staff of the Health Branch is to be congratulated on the way in which each of the scattered cases was tracked down and dealt with.

### 4.—Cholera.

No case occurred.

### 5.—Plague.

No case occurred.

### 6.—Cerebro-spinal Meningitis.

During the early part of the year there were reports of cerebro-spinal meningitis in epidemic form in Chinese and other Far Eastern ports, and it was feared that the disease might be introduced into Malaya by way of Singapore. No such introduction occurred: the disease appeared instead at Port Swettenham, among immigrants from India, where the disease had not been reported. The passengers from the ships in which cases were discovered were kept in quarantine for a prolonged period, during which fresh cases continually occurred; the case mortality was extremely high. Eventually it was found possible to release, in successive batches, all the immigrants who had been kept under observation. A few isolated cases thereafter appeared in different parts of the country, but there was no epidemic

### 7.—Tropical Typhus.

There was a large increase in the number of cases of tropical typhus reported during the year, from 57 in 1928 to 166 in 1929. There were 11 deaths. Of these cases three were Europeans. It may be that this increase can be partly explained by the careful search now being made for cases of this disease; but there would seem to be little doubt that its incidence has been affected by the increase in oil-palm cultivation. In the report of the Institute of Medical Research will be found a full account of the features of tropical typhus in this country, and the investigation which is being made into its aetiology.

### 8.—Enteric Fever.

The number of cases of enteric fever diagnosed in Government hospitals was 261, as compared with 153 in the previous year. This is an increase of 70 per cent. which may perhaps be partly explained by more careful diagnosis. The deaths numbered 59, a mortality of 22.6 per cent. of admissions.

### 9.—Pneumonia.

Any account of the health of the Federated Malay States must allow a prominent position to pneumonia, since this is one of the deadliest of the killing diseases of the country. The number of cases described as pneumonia, admitted to Government hospitals in 1929, was 3,227, of which 1,470 were fatal; this is a case mortality of 45.55 per cent.

These cases have been grouped under the head of pneumonia, regardless of whether they are described in the case sheets as lobar pneumonia or broncho-pneumonia, since the distinction between these two conditions, as observed or as recorded, is not always clear. It is probable that some of the 28 deaths recorded under "acute bronchitis" might be included in the same category, as also 46 deaths under pleurisy and empyema. Typical lobar pneumonia occurs frequently enough, but a condition of broncho-pneumonia, associated with marked toxaemia, is relatively common.

Fewer cases of pneumonia were admitted in 1929 than in 1928, there being a reduction of about 8 per cent., and the case mortality was lower, 45.55 as against 48.11 per cent. It is worth noting that the decrease in the number of cases and deaths was not proportionate to the decrease in malaria admissions, which, as previously mentioned, was nearly 30 per cent.; in other words, there is evidence of other factors than malaria influencing the incidence of pneumonia.

No progress in the treatment of pneumonia can be recorded. The use of oxygen by subcutaneous injection, mentioned in last year's report, was continued at Ipoh, and tried elsewhere. At Ipoh, 101 cases were treated with oxygen, 118 without: excluding those cases in which death occurred within 24 hours of admission, the death-rate was the same in both series. There is therefore no evidence that the administration of oxygen had any effect on the mortality; though, since these cases included very few which could be called typical lobar pneumonia for which condition oxygen is presumably particularly indicated, the test may be considered inconclusive. The effect of the injections of oxygen in relieving dyspnoea and distress was obvious.

It is regrettable that the case mortality should stand so high, over 45 per cent.; this is much too high, in spite of the fact that so many cases are admitted in a very advanced and practically moribund condition.

As regards racial incidence, the following figures from hospitals in Selangor, Negri Sembilan and Pahang are interesting:

| | Admissions. | Deaths. | Mortality. |
|---|---|---|---|
| Indians ... ... ... | 1,467 | 550 | 37.49 per cent. |
| Chinese ... ... ... | 521 | 353 | 67.75 ,, |
| Malays ... ... ... | 48 | 9 | 18.75 ,, |

## 10.—Pulmonary Tuberculosis.

There is difficulty in correctly estimating the incidence of pulmonary tuberculosis throughout the country as a whole, on account of the unreliability of death returns for the rural districts. It is fashionable to represent pulmonary tuberculosis as being rapidly increasing in Malaya. In last year's report attention was called to the fact that the number of deaths annually reported as due to this disease had remained remarkably constant for the previous six years, being about 2,000. The figure for 1929 was 2,080. The Registrar-General's returns, therefore, do not confirm the idea of rapid increase. If it be contended that many cases are never recorded, it may be answered that pulmonary tuberculosis is principally a disease of towns, where registration of deaths is relatively reliable.

The number of new cases admitted to Government hospitals was 2,006, and since the deaths numbered 1,078 the mortality was over 50 per cent. Admissions and death-rate cannot be compared with previous years, on these figures, since in previous years cases transferred from one hospital to another were recorded as new admissions. The number of deaths in hospitals in 1928 was 1,074.

The subject of pulmonary tuberculosis in the Federated Malay States was fully discussed at a meeting of the British Medical Association held in Kuala Lumpur in October. No evidence of any marked increase of the disease, even in the towns, was brought forward, and statements were made, supported by statistics, of its infrequency among estate labourers and school children. In view of housing conditions and the state of malnutrition of many of the population, it is surprising that the incidence of the disease is not much greater.

Figures of the racial incidence of pulmonary tuberculosis have been collected for three States. They are as under:

| | Admissions. | Deaths. | Mortality. |
|---|---|---|---|
| Indians ... ... ... | 509 | 219 | 43 per cent. |
| Chinese ... ... ... | 682 | 376 | 55 ,, |
| Malays ... ... ... | 85 | 12 | 14 ,, |

### 11.—Leprosy.

The number of new cases admitted for detention during the year was 251. It has proved extremely difficult to ascertain the yearly number of cases of leprosy detected throughout the Federated Malay States during past years, since the returns have been complicated by the confusion of new cases with cases transferred from a hospital to an asylum. Hence the figures in previous reports have been quite misleading, being greatly in excess of the actual numbers of new cases. So far as can now be determined the new admissions during the last four years, and the number of deaths, were as follows:

| Year. | New cases. | Deaths. |
|---|---|---|
| 1926 | 231 | 66 |
| 1927 | 245 | 80 |
| 1928 | 289 | 69 |
| 1929 | 251 | 79 |

It would thus appear that the average annual number of admissions during this period has been 254, and of deaths 73.5.

At the end of the year the number of lepers under detention was 1,055, of which 983 were in the Leper Settlement at Kuala Lumpur, and 61 in the Malay Leper Settlement at Pulau Pangkor Laut. There were also 111 lepers in the Penang Leper Settlement at Pulau Jerejak, who originally came from the Federated Malay States.

Of the 1,055 lepers, 800 were Chinese, 176 Indians and 73 Malays. No case was discharged, since there has been no opportunity of segregating those bacteriologically negative from the infective cases. For this reason it is most important that the new Leper Settlement at Sungei Buloh should be ready for occupation without any further delay.

The object to be attained is the discovery and treatment of as many early cases of leprosy among the population as possible, for only so can the incidence of the disease be controlled. Wherever practicable, lepers should be allowed to attend for treatment at special clinics without being arrested and confined. In the case of those who must be confined, there should be provision for the release of non-infective cases after a probationary period of observation. With these two alterations in procedure it may be hoped that early cases will come forward for treatment. Under present conditions, the diagnosis of leprosy being equivalent to a sentence of imprisonment for life, it is not surprising that lepers should try to conceal themselves.

An account of the Leper Settlements will be found in Section VII, "Institutions for Mental Diseases and Leprosy".

### 12.—Yaws.

The number of cases reported as having come under treatment during the last five years is shown in the following table:

| State. | 1925. | 1926. | 1927. | 1928. | 1929. |
|---|---|---|---|---|---|
| Perak | 9,155 | 9,358 | 2,307 | 10,007 | 8,845 |
| Selangor | 1,305 | 1,680 | 2,504 | 1,999 | 1,458 |
| Negri Sembilan | 6,426 | 4,543 | 4,465 | 4,280 | 3,721 |
| Pahang | 9,403 | 7,893 | 3,913 | 3,286 | 2,421 |
| Total | 26,289 | 23,474 | 13,189 | 19,572 | 16,445 |

### 13.—Helminthic Disease.

The routine microscopical examination of the faeces of hospital patients provides a mass of figures, which are of doubtful value as an indication of the relative prevalence of the different helminths. Examination is usually only made by a simple smear preparation, so that a large number of cases of light infestation must be missed. Further, hospital patients are not typical of the general population, The following figures may be quoted, from Perak and Negri Sembilan:

| | Perak. | Negri Sembilan. |
|---|---|---|
| Number of patients examined | 51,875 | 18,925 |
| Total number of examinations | 94,413 | 37,299 |
| Patients with ova of ascaris | 13,490 | 3,207 |
| Percentage of ascaris infestation | 26.01 | 16.94 |
| Patients with ova of ankylostome | 6,982 | 1,863 |
| Percentage of ankylostome infestation | 13.46 | 9.84 |

Figures from Pahang show corresponding percentages of 11.33 and 8.62, in 12,567 patients examined.

The records of admissions to hospitals for ankylostomiasis and ascariasis are of little value, since there is always a tendency to make use of the discovery of ova in the faeces to provide a diagnosis for doubtful cases of disease, regardless of clinical symptoms. It is therefore difficult to determine the number of cases in which ankylostome infestation is the principal cause of illness or death. The prevailing opinion, probably well founded, is that ankylostome infestation is common, but usually only seriously harmful in association with other disease such as chronic malaria. In such association it may be the principal factor in the illness, and the direct cause of death.

The pathological significance of ascaris infestation is even more obscure, and there are no ascertained facts to justify any positive statement.

The rarity of tapeworm infestation is remarkable.

### 14.—Beri-Beri.

The number of cases treated in hospitals was 1,640 with 197 deaths, as compared with 2,098 cases with 239 deaths in 1928. The total number of deaths registered as due to beri-beri throughout the country was 636. There is thus evidence of a further satisfactory decrease in the incidence of this disease, after the comparatively heavy incidence which followed the 1926-1927 floods. The pity is that a disease so easily preventable should be present at all. The remedy lies in education in the elementary principles of nutrition.

### 15.—Chronic Ulcer.

Attention may be called to the large number of cases of chronic ulcer always to be found under treatment in hospital. The total number recorded during 1929 was 3,521. No figures for previous years are available for comparison. This figure for total cases treated represents a very great amount of invaliding and, incidentally, a corresponding expense for maintenance and treatment in hospital, since most cases remain in hospital for a period of many weeks or months.

An indication of the relative incidence in different races is given by the following figures, from three States only:

| | |
|---|---|
| Indians | 1,233 |
| Chinese | 1,949 |
| Malays | 313 |

This condition of chronic and intractable ulceration is difficult to explain. Deficient nutrition is a tempting hypothesis, but direct evidence is lacking. The figures of racial incidence do not seem to support such a hypothesis. There is no doubt that most of the cases could be prevented by early attention to trivial injuries. Any practicable measure for the prevention of these ulcers, and any improvement in methods of treatment, would result in great economic gain, the total disability in the working population from this cause being at present very great.

### 16.—Cirrhosis of the Liver.

Another condition to which attention may be directed is cirrhosis of the liver. This is comparatively frequent. The causation is obscure: only a few cases can be explained as being due to alcohol. The total number of cases reported during the year was 388. A proportion of these cases have been analysed to show relative racial incidence, as follows:

| | Admissions. | Deaths. |
|---|---|---|
| Indians | 56 | 33 |
| Chinese | 136 | 64 |
| Malays | 6 | 3 |

### 17.—Cancer.

The number of cases admitted and treated in Government hospitals under the heading of "Cancer or other malignant tumours" was 315, with 136 deaths. These figures are practically the same as those reported for the previous year. The fact that only 23 deaths are recorded by the Registrar-General of Births and Deaths under the head of cancer is curious, and shows the possibility of error in compiling statistics from death certificates.

A statement of the nature of the tumours examined microscopically at the Institute for Medical Research will be found in the report of the Institute. Of 112 malignant tumours so examined, 64 were from Chinese patients, 31 from Tamils, and 17 from Malays. Only 24 of these 112 tumours were sarcomata. There were five specimens of primary carcinoma of the liver, all Chinese.

### 18.—Venereal Diseases.

A full statement of the incidence and treatment of venereal diseases will be found in the report of the Chief Medical Officer, Social Hygiene. (Appendix 3).

## DISEASE AMONG EUROPEANS.

The total number of admissions of European patients to Government hospitals, excluding normal maternity cases, was 1,273. With an estimated European population of 7,669, the admission rate was 16.59 per cent. The number of deaths recorded by the Registrar-General was 42: of these 22 occurred in hospital.

Of the total admissions to hospital, 277 were diagnosed as malaria, 21.76 per cent.

Admissions for certain other diseases were as follows:

| | |
|---|---|
| Appendicitis ... ... ... ... ... ... ... ... | 61 |
| Dysentery ... ... ... ... ... ... ... ... | 22 |
| Enteric fever ... ... ... ... ... ... ... | 13 |
| Dengue ... ... ... ... ... ... ... ... | 17 |
| Leptospirosis ... ... ... ... ... ... ... | 6 |
| Pneumonia ... ... ... ... ... ... ... ... | 4 |
| Pulmonary tuberculosis ... ... ... ... ... ... | 3 |

The number of cases of appendicitis is remarkable. It is 4.79 per cent. of all European admissions. The total number of cases of appendicitis, other than European, admitted to Government hospitals was only 184; that is to say, the proportion between European and other cases was 1 to 3, while the proportion between the total of European hospital admissions for all diseases and the total of hospital in-patients of other races was approximately 1 to 90.

# III.—HYGIENE AND SANITATION.

This section together with Section IV, Port Health Work, and Section V, Infant Welfare, is the report of the Acting Chief Health Officer.

## GENERAL REVIEW OF WORK DONE AND PROGRESS MADE.

### (i) PREVENTIVE MEASURES.

### 1.—Malaria.

This mosquito-borne disease continues to be the chief cause of sickness and death in this country, and, as in previous years, all forms of anti-malarial measures were employed, the chief of these of course being mosquito reduction. Having studied the habits of our local anophelines, we have aimed at reducing the number of breeding places by either (*a*) putting the water underground, e.g., sub-soil draining, or (*b*) making the streams or pools unfavourable for the female anopheline to lay her eggs in, by means of "oiling", which also kills any larvæ which may already have been hatched out.

In Sanitary Board areas anti-malarial measures are undertaken by Mosquito Destruction Boards, the personnel of a Board usually consisting of a Health Officer as Chairman, the Executive Engineer, the Chairman of the Sanitary Board, a local European practitioner, and three or four European and Asiatic planters, miners, etc. The executive officers are Inspectors, larvæ collectors, and oiling and clearing gangs of coolies. During the year 1929 the amount spent by the various Boards was as follows:

| | |
|---|---|
| Perak ... ... ... ... ... ... ... | $212,495.80 |
| Selangor ... ... ... ... ... ... ... | 214,968.35 |
| Negri Sembilan ... ... ... ... ... ... | 158,022.16 |
| Pahang ... ... ... ... ... ... ... | 100,727.45 |
| Total ... | $686,213.76 |

$1=2*s*. 4*d*. sterling.

This expenditure may be briefly divided under the following headings:

Temporary work: oiling and ditching, including the cost of oil;

Permanent work: open or sub-soil drains;

Maintenance: upkeep of sub-soiled areas.

The Malaria Advisory Board met on several occasions in Kuala Lumpur; besides being advisory, this Board is responsible for the propaganda in connexion with anti-malarial measures throughout the country.

Clearance of Bush: The clearance of bush and undergrowth is done on public lands by Sanitary Boards or Mosquito Destruction Boards. The clearance of bush at a wet hill-foot in this country almost certainly favours the propagation of *A. maculatus* (Theobald), which is our most important malaria carrier. Notices calling attention to this danger appear frequently in the Press and in the form of posters; nevertheless many a healthy area has been rendered malarious by clearing such bush without expert advice.

On many estates active anti-malarial measures are in force under supervision of their Visiting Medical Practitioners; these estates are inspected by officers of the Health Branch, and every assistance is given either by checking mosquito surveys already carried out by the estate staff, or in many cases, by carrying out quite independent surveys, and giving advice at the request of the estate authorities.

Under the Health Boards Enactment, it is also intended to deal with small estates and kampong areas, which hitherto have had little or no anti-malarial work carried out, and are not only unhealthy themselves but a menace to their neighbours.

As an anti-malarial measure, tablets of quinine to the number of 1,220,800 were supplied by the Health Branch during the year. These tablets are packed in tubes, each tube containing twenty tablets of four grains of quinine hydrochloride, enclosed in a wrapper giving directions in the various languages of the country as to how and when this remedy should be used. The tubes are distributed free of charge to the public through District Offices, Police Stations, the Post Offices and the Education Department. The Senior Medical Officers of the four States are also supplied with these tablets for ultimate distribution by means of the travelling dispensaries.

The importance of an early anti-malarial campaign in an area in which large public works are to be undertaken cannot be over-estimated. The building of the road to Cameron's Highlands in Perak, and the construction of the Ulu Sleh Water Works and the Sungei Buloh Decrepit Home and Leprosorium in Selangor, furnish examples where, notwithstanding the prevalence of ideal conditions for epidemic malaria, large healthy labour forces have been maintained under temporary conditions at very reasonable expenditure. Co-operation between the departments concerned has in these cases resulted in the engineers having a healthy labour force at their disposal, a highly important factor from the economical point of view in the carrying out of public works of magnitude without undue delay.

### 2.—Smallpox.

Ten cases were notified during the year, nine of which were in the Kuala Lumpur district of Selangor and one in Negri Sembilan. Two of the Selangor cases proved fatal. Disinfection of the premises, isolation of the patient and contacts, and mass vaccination of contacts and those living in the vicinity of the case, prevented any spread of the disease. Vaccination is under the control of the Senior Medical Officers; but a large number of vaccinations, chiefly amongst school children, were carried out by the Health Branch in addition to those referred to above.

### 3.—Epidemic Cerebro-spinal Fever.

There were 38 cases of this disease with 21 deaths, of which 8 occurred in Perak, 26 in Selangor, 3 in Negri Sembilan and 1 in Pahang. An outbreak in the Quarantine Camp, Port Swettenham, referred to later, amongst newly arrived coolies from India, which commenced in May, was probably the cause of the majority of the cases in Selangor. Isolation of cases, serum treatment and disinfection were employed; the cases were mostly sporadic.

### 4.—Diphtheria.

Eighty-eight cases with 27 deaths were notified during the year, 35 in Perak, 40 in Selangor, 8 in Negri Sembilan and 5 in Pahang. This disease is increasing, but no epidemic has ever been reported, the recorded outbreaks being sporadic in nature. It was pointed out a few years ago that the increase might be due to the large number of female immigrants and consequent increase in the child population.

In Perak in two small outbreaks it is probable that the infection was conveyed through milk, in both cases the person supplying the milk being found to be an infective carrier.

### 5.—Pulmonary Tuberculosis.

This disease is notifiable in several of the large towns. On the notification of such cases the address is visited and other cases amongst the household looked for. Simple disinfection is carried out and advice given to the occupants.

Members of the Government Clerical Service and some other branches are examined yearly with a view to getting hold of early cases.

### 6.—Helminthic Diseases.

Ankylostomiasis is the important disease of this group, a very high percentage of the native population being infected in various degrees, in addition to harbouring ascarids. Improved methods of disposal of night-soil, better sanitation around cooly lines and native houses, and propaganda directed against the eating of uncooked vegetables will, it is hoped, in time reduce the incidence of these infections.

## (ii) GENERAL MEASURES OF SANITATION.

Sanitation in the towns is provided for by the Sanitary Boards under the Sanitary Boards Enactment.

### 1.—Sewage Disposal.

No town has as yet a water-borne system of disposal. In the large towns some of the public buildings, public latrines and many of the residential houses have septic tank installations; otherwise, the houses employ the bucket system, which is universal in shop-house areas. The ultimate disposal in the bucket system is by trenching. In small villages and on estates, pit latrines are the rule; a few possess bucket latrines, and fewer still the water-borne system.

### 2.—Water Supplies.

The high rainfall in Malaya provides generally an ample supply of drinking water to the majority of the towns, the supply being collected and piped from uninhabited areas. Slow sand filtration and mechanical filters are both in use, and chlorination is also adopted in certain cases. During the year the water supply of Kuala Lumpur was considerably augmented by the opening of the Kuala Sleh water works; good progress was made at the new water works in the Kinta district of Perak, which will benefit Ipoh and many neighbouring towns. In many other districts the water supplies are being increased and improved. The coastal areas are not so fortunate and in many cases have to rely on wells, most of which are subject to pollution.

Some estates are enabled to have a satisfactory piped supply, either from Government mains or by pipes from their own catchment areas, others rely on wells.

By having catchment areas gazetted as "Forest Reserves" it has been possible to keep them almost free from the risk of human pollution.

The Institute for Medical Research undertakes the regular routine examination of the water supplies to all the larger towns, in addition to numerous reports on smaller installations and wells.

### 3.—Scavenging.

This is fairly satisfactory in most towns. The best method of disposal, viz., incineration, is generally adopted; where this is not possible, dumping or the filling in of swampy areas is resorted to, due care being taken to prevent fly breeding. Modern collecting motor vehicles, covered to prevent rubbish and dust being blown about, are employed in most towns. In Taiping the Senior Health Officer, Perak, attributes the lowering of the general death-rate, especially that from bowel diseases, as being due to improved scavenging in this town. In addition to the scavenging by Sanitary Board coolies in the town, an enormous number of empty tins, bottles and cocoanut shells are collected daily and burnt or buried by coolies of the Mosquito Destruction Boards, a systematic combing out of the Sanitary Board area being a routine to prevent or rather limit the mosquito nuisance by the destruction of these artificial breeding places.

### 4.—Drainage.

The Sanitary Boards control street drainage in towns. Anti-malarial drainage is controlled by the Mosquito Destruction Boards.

The laying of sub-soil pipes was continued by the Anti-malarial Branch of the Public Works Department in many areas; in Kuala Lumpur alone there are approximately 200 miles of sub-soil pipes.

## (iii) SCHOOL HYGIENE.

The number of Government and State aided schools in the Federated Malay States are as follows:

| | |
|---|---|
| Government English Schools ... ... ... ... ... | 23 |
| Aided English Schools ... ... ... ... ... ... | 26 |
| Government Vernacular Schools— | |
| Boys ... ... ... ... ... ... ... ... | 440 |
| Girls ... ... ... ... ... ... ... ... | 77 |

There are also many private schools, and many schools on estates.

Medical inspection of schools was shared by the hospital and health branches of the Medical Department.

Eight hundred and eighty-nine visits to schools, including estate schools, were paid by officers of the Health Branch, and 41,185 school children examined. These visits do not include the work of the Lady Medical Inspectors of Schools in Perak and Selangor, which will be referred to later.

The spleen rates in the four States for all schools were as follows:

| | | |
|---|---|---|
| Perak ... ... ... ... ... ... ... ... | 5.72 | per cent. |
| Selangor ... ... ... ... ... ... ... | 6.72 | ,, |
| Negri Sembilan ... ... ... ... ... ... | 18.12 | ,, |
| Pahang ... ... ... ... ... ... ... | 18.40 | ,, |

Simple instruction in health matters was given by the inspecting officer in most cases; a stock of quinine is kept by the school masters, and many of the schools are visited regularly by the travelling dispensaries. Children who had no marks of previous vaccination were vaccinated.

The Lady Medical Inspector of Schools in Selangor visited 82 schools (girls' schools, and elementary mixed schools). Visits paid numbered 243, and the number of pupils examined was 8,264, of whom 3,869 were girls and 3,395 boys; these included all nationalities. In Perak the Lady Medical Inspector commenced duty on 1st July; 47 schools were visited, and 3,250 pupils examined.

As may be expected, marked differences of conditions exist in the English schools in the towns as compared with the vernacular schools in the districts. In the former, evidences of recent malaria, worm infection and skin diseases were seldom seen, but were prevalent in the vernacular schools. Dental caries is very common at all schools, more especially at those sited in towns. The general sanitation of schools is still far from satisfactory in many cases, especially in rural areas, though a good deal has been recently done in this respect. The most important defects are deficient or unsatisfactory latrine accommodation and the want of a pure water supply. Lecture demonstrations in hygiene were given to Malay women teachers in the schools, and active health propaganda was carried on throughout the year by personal instruction and the distribution of various pamphlets.

A Government Dental Clinic with a Dental Surgeon in charge was opened on 1st July, in Kuala Lumpur. The primary duties of the Dental Surgeon are examination and treatment of school children.

During the half-year, 15 schools, 13 in Selangor and 2 in Perak, were visited and 2,532 pupils were examined; the average percentage of children needing attention was 72.5, and 944 children were treated, 802 extractions and 1,323 fillings being done.

Clinics were established in such English schools as were convenient from point of view of numbers and where accommodation was suitable. Lighter portable equipment was carried for use in the outstation vernacular schools. Urgent cases attended at the permanent clinic on certain fixed days. Schools were visited in various types of districts so that data could be obtained as to the probable amount of dental attention required throughout the Federation.

The Dental Surgeon in his report emphasizes the necessity for dental propaganda, considering that most of the dental diseases could be prevented or cured in the initial state if scientific cleaning and a rudimentary knowledge of diet was understood. He deplores the condition of the teeth examined in the schools especially in the big centres, and states that he can merely touch the fringe of the extremely large field that the examination of the schools shows to exist.

## (iv) LABOUR CONDITIONS.

### (A) Estates.

Estates and estate hospitals were visited throughout the year as usual by European and Asiatic officers of the Health Branch. The necessity for improving, where required, the housing conditions, drainage, water supplies and night-soil and refuse disposal is pointed out as not only a legal requirement but as an important factor from an economic point of view. Conditions vary very much in estates as regards medical supervision and hospital facilities, and those lacking in these important services receive more of our attention. Malaria on estates is the most important and urgent health problem, and every assistance is given, when asked for, to help to combat this disease. It is considered that the standard of living and general sanitation on rubber estates is steadily, if slowly, improving; in this connexion we must remember that the present low price of the commodity affects the carrying out of expensive improvements. As is to be expected, the death-rate for dependants of labourers is much higher than that of the labour force; but the care of the dependant is important in that disease among dependants is as likely to react adversely on the health of an estate as disease among the labourers themselves.

Much time was spent by Health Officers in trying to get proposals adopted to organize medical and hospital services for estates and their surroundings under the Health Boards Enactment. These are proposals to provide generally the regular systematic supervision and hospital facilities needed for efficient sanitation, anti-malarial and other preventive measures and treatment of the sick. It is difficult to introduce new procedures, and progress has been slow.

## LABOUR ON ESTATES.

### Table A.

### DISTRIBUTION OF LABOUR IN THE FOUR STATES.

| | Indians. | Others. | Total. |
|---|---|---|---|
| **Perak.—** | | | |
| Larut, Matang, Krian and Selama | 17,269 | 2,615 | 19,884 |
| Kuala Kangsar and Upper Perak | 9,876 | 4,261 | 14,137 |
| Kinta | 7,703 | 1,523 | 9,226 |
| Lower Perak | 17,502 | 708 | 18,210 |
| Batang Padang | 8,741 | 1,765 | 10,506 |
| **Selangor.—** | | | |
| Selangor East | 21,456 | 5,707 | 27,163 |
| Selangor Coast | 46,795 | 1,435 | 48,230 |
| **Negri Sembilan.—** | | | |
| Seremban, Jelebu and Coast | 18,550 | 11,707 | 30,257 |
| Tampin and Kuala Pilah | 9,835 | 9,851 | 19,686 |
| **Pahang.—** | | | |
| Pahang West | 3,444 | 4,899 | 8,343 |
| Pahang East | 1,456 | 5,555 | 7,011 |
| Total F.M.S. | 162,627 | 50,026 | 212,653 |

### Table B.

### ANNUAL DEATH-RATE SINCE 1911.

| Year. | Total number of estate labourers. | Deaths. | Death-rate per mille. |
|---|---|---|---|
| 1911 | 143,614 | 9,040 | 62.9 |
| 1912 | 171,968 | 7,054 | 41.02 |
| 1913 | 182,937 | 5,592 | 29.6 |
| 1914 | 176,226 | 4,635 | 26.3 |
| 1915 | 169,100 | 2,839 | 16.78 |
| 1916 | 187,030 | 3,299 | 17.61 |
| 1917 | 214,972 | 3,906 | 18.61 |
| 1918* | 213,425 | 9,081 | 42.55 |
| 1919 | 216,573 | 3,384 | 15.16 |
| 1920 | 235,156 | 4,367 | 18.57 |
| 1921 | 175,649 | 3,195 | 18.19 |
| 1922 | 159,279 | 2,556 | 16.05 |
| 1923 | 147,276 | 1,924 | 13.06 |
| 1924 | 144,902 | 1,514 | 10.45 |
| 1925 | 146,558 | 1,585 | 10.81 |
| 1926† | 181,204 | 2,632 | 14.53 |
| 1927 | 207,086 | 3,619 | 17.48 |
| 1928 | 195,961 | 2,953 | 15.07 |
| 1929 | 212,653 | 2,273 | 10.69 |

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* Influenza year. † Excluding Pahang.

# TABLE C.

## ADMISSIONS TO HOSPITAL, AND TOTAL DEATHS, LABOURERS ONLY, ALL NATIONALITIES.

| Divisions. | No. of labour force only. All nationalities. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | In hospital. | | Outside hospital. | | |
| | | Estate. | Govt. | Total. | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 19,884 | 2,641 | 827 | 3,468 | 174.41 | 82 | 40 | 28 | 150 | 7.54 |
| Kuala Kangsar and Upper Perak ... | 14,137 | 2,216 | 702 | 2,918 | 206.41 | 87 | 48 | 29 | 164 | 1.16 |
| Kinta ... ... ... ... | 9,226 | 1,425 | 876 | 2,301 | 249.40 | 22 | 62 | 14 | 98 | 10.62 |
| Lower Perak ... ... ... | 18,210 | 5,354 | 505 | 5,859 | 321.75 | 95 | 26 | 16 | 137 | 7.52 |
| Batang Padang ... ... ... | 10,506 | 2,060 | 729 | 2,789 | 265.37 | 29 | 46 | 9 | 84 | 7.99 |
| Selangor East ... ... ... | 27,163 | 5,920 | 2,682 | 8,602 | 316.68 | 110 | 153 | 32 | 295 | 10.86 |
| ,, Coast ... ... ... | 48,230 | 11,862 | 576 | 12,438 | 257.89 | 314 | 36 | 34 | 384 | 8.23 |
| Seremban, Jelebu and Coast ... | 30,257 | 10,183 | 2,207 | 12,390 | 409.49 | 244 | 122 | 28 | 394 | 13.02 |
| Tampin and Kuala Pilah ... ... | 19,686 | 4,550 | 1,784 | 6,334 | 321.75 | 135 | 167 | 44 | 346 | 17.58 |
| Pahang West ... ... ... | 8,343 | 1,558 | 793 | 2,351 | 281.80 | 31 | 53 | 22 | 106 | 12.70 |
| ,, East ... ... ... | 7,011 | 5,456 | 328 | 5,784 | 824.98 | 85 | 26 | 4 | 115 | 16.42 |
| Total ... | 212,653 | 53,225 | 12,009 | 65,234 | 306.76 | 1,234 | 779 | 260 | 2,273 | 10.69 |

## Table D.

### ADMISSIONS TO HOSPITALS, AND TOTAL DEATHS, LABOURERS AND DEPENDANTS, ALL NATIONALITIES.

| Divisions. | Total estate population all nationalities labour force and dependants. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | In hospital. | | Outside hospital. | | |
| | | Estate. | Govt. | Total. | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 28,827 | 3,572 | 1,463 | 5,035 | 174.66 | 321 | 53 | 143 | 517 | 17.80 |
| Kuala Kangsar and Upper Perak ... | 16,753 | 3,383 | 1,073 | 4,456 | 265.92 | 156 | 86 | 71 | 313 | 18.68 |
| Kinta ... ... ... ... | 12,092 | 1,791 | 1,321 | 3,112 | 257.36 | 56 | 125 | 60 | 241 | 19.92 |
| Lower Perak ... ... ... | 26,888 | 7,976 | 722 | 8,698 | 323.45 | 321 | 72 | 116 | 509 | 18.93 |
| Batang Padang ... ... ... | 13,854 | 2,858 | 957 | 3,815 | 275.37 | 114 | 80 | 35 | 229 | 16.53 |
| Selangor East ... ... ... | 35,074 | 8,067 | 3,259 | 11,326 | 322.92 | 292 | 361 | 117 | 770 | 21.95 |
| ,, Coast ... ... ... | 66,896 | 17,552 | 784 | 18,336 | 274.10 | 1,079 | 55 | 319 | 1,453 | 21.72 |
| Seremban. Jelebu and Coast ... | 34,987 | 12,195 | 2,749 | 14,944 | 427.13 | 432 | 207 | 78 | 717 | 20.49 |
| Tampin and Kuala Pilah ... ... | 22,195 | 5,271 | 2,059 | 7,330 | 330.25 | 212 | 216 | 91 | 519 | 23.38 |
| Pahang West ... ... ... | 9,700 | 1,958 | 964 | 2,922 | 301.24 | 61 | 90 | 66 | 217 | 22.37 |
| ,, East ... ... ... | 7,974 | 5,768 | 345 | 6,113 | 766.61 | 108 | 31 | 56 | 195 | 24.45 |
| Total ... | 275,240 | 70,391 | 15,696 | 86,087 | 312.77 | 3,152 | 1,376 | 1,152 | 5,680 | 20.64 |

## Table E.

### DEATHS AMONG LABOURERS, AND AMONG DEPENDANTS.

| Total number of estate labourers. | Deaths. | Death-rate. | Total number of dependants. | Deaths. | Death-rate. |
|---|---|---|---|---|---|
| 212,653 | 2,273 | 10.69 | 62,587 | 3,407 | 54.44 |

## TABLE F.

### INDIAN LABOURERS: ADMISSIONS TO HOSPITALS, AND TOTAL DEATHS.

| Divisions. | No. of labour force Indians only. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | In hospital. | | Outside hospital. | | |
| | | Estate. | Govt. | Total. | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 17,269 | 2,637 | 793 | 3,430 | 198.62 | 95 | 44 | 4 | 143 | 8.28 |
| Kuala Kangsar and Upper Perak... | 9,876 | 2,090 | 686 | 2,776 | 281.09 | 79 | 44 | 16 | 139 | 14.07 |
| Kinta... ... ... ... ... | 7,703 | 1,421 | 873 | 2,294 | 297.81 | 21 | 62 | 14 | 97 | 12.59 |
| Lower Perak... ... ... ... | 17,502 | 5,262 | 295 | 5,557 | 317.51 | 95 | 25 | 16 | 136 | 7.77 |
| Batang Padang ... ... ... | 8,741 | 2,060 | 725 | 2,785 | 318.61 | 29 | 44 | 9 | 82 | 9.38 |
| Selangor East ... ... ... | 21,456 | 5,662 | 2,444 | 8,106 | 377.79 | 101 | 146 | 15 | 262 | 12.22 |
| ,, Coast ... ... ... | 46,795 | 11,846 | 525 | 12,371 | 264.37 | 313 | 35 | 34 | 382 | 8.16 |
| Seremban, Jelebu and Coast ... | 18,550 | 7,371 | 1,586 | 8,957 | 482.86 | 219 | 83 | 18 | 320 | 17.25 |
| Tampin and Kuala Pilah ... ... | 9,835 | 4,129 | 1,351 | 5,480 | 557.19 | 119 | 135 | 24 | 278 | 28.27 |
| Pahang West ... ... ... | 3,444 | 980 | 732 | 1,712 | 497.10 | 19 | 53 | 15 | 87 | 25.26 |
| ,, East ... ... ... | 1,456 | 743 | 212 | 955 | 655.90 | 26 | 10 | 1 | 37 | 25.41 |
| Total ... | 162,627 | 44,201 | 10,222 | 54,423 | 334.65 | 1,116 | 681 | 166 | 1,963 | 12.07 |

## Table G.

### INDIAN LABOURERS AND DEPENDANTS: ADMISSIONS TO HOSPITALS AND TOTAL DEATHS.

| Divisions. | No. of labour force and dependants Indians only. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | In hospital. | | Outside hospital. | | |
| | | Estate. | Govt. | Total. | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 25,379 | 3,572 | 1,402 | 4,974 | 195.98 | 313 | 53 | 144 | 510 | 20.09 |
| Kuala Kangsar and Upper Perak ... | 12,183 | 2,400 | 849 | 3,249 | 266.68 | 167 | 98 | 18 | 283 | 23.22 |
| Kinta ... ... ... ... | 10,340 | 1,787 | 1,318 | 3,105 | 300.29 | 55 | 124 | 56 | 235 | 22.73 |
| Lower Perak ... ... ... | 26.119 | 7,867 | 720 | 8,587 | 327.21 | 303 | 71 | 116 | 490 | 18.76 |
| Batang Padang ... ... ... | 11,795 | 2,793 | 987 | 3,780 | 320.47 | 120 | 72 | 31 | 223 | 18.90 |
| Selangor East ... ... ... | 28,365 | 8,068 | 3,575 | 11,643 | 410.47 | 279 | 330 | 115 | 724 | 25.52 |
| ,, Coast ... ... ... | 65,105 | 17,541 | 733 | 18,274 | 280.68 | 1,077 | 54 | 319 | 1,450 | 22.27 |
| Seremban, Jelebu and Coast ... | 23,759 | 9,125 | 1,960 | 11,085 | 466.56 | 414 | 163 | 59 | 636 | 26.77 |
| Tampin and Kuala Pilah ... ... | 11,941 | 4,837 | 1,626 | 6,463 | 541 25 | 188 | 183 | 70 | 441 | 36.93 |
| Pahang West ... ... ... | 3.637 | 1,300 | 835 | 2,135 | 587.02 | 36 | 76 | 39 | 151 | 41.52 |
| ,, East ... ... ... | 1,985 | 799 | 230 | 1,029 | 518.38 | 38 | 3 | 5 | 46 | 23.17 |
| Total ... | 220,608 | 60,089 | 14,235 | 74,324 | 336.77 | 2,990 | 1,227 | 972 | 5,189 | 23.52 |

## Table H.

### MALARIA.

### ADMISSIONS TO HOSPITAL FOR MALARIA, AND DEATHS FROM MALARIA, LABOURERS ONLY, ALL NATIONALITIES.

| Divisions. | No. of labour force only. All nationalities. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Estate. | Govt. | Total. | | In hospital. | | Outside hospital. | | |
| | | | | | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 19,884 | 527 | 238 | 765 | 38.47 | 15 | 5 | 3 | 23 | 1.16 |
| Kuala Kangsar and Upper Perak ... | 14,137 | 959 | 172 | 1,131 | 80.03 | 13 | 7 | 2 | 22 | 1.56 |
| Kinta ... ... ... ... | 9,226 | 643 | 185 | 828 | 89.75 | 5 | 14 | 2 | 21 | 2.28 |
| Lower Perak ... ... ... | 18,210 | 667 | 26 | 693 | 38.06 | 5 | 2 | 1 | 8 | 0.44 |
| Batang Padang ... ... .. | 10,506 | 584 | 102 | 686 | 65.29 | 12 | 5 | 2 | 19 | 1.81 |
| Selangor East ... ... ... | 27,163 | 2,156 | 330 | 2,486 | 91.52 | 20 | 32 | 4 | 56 | 2.06 |
| ,, Coast ... ... ... | 48,230 | 3,253 | 155 | 3,408 | 74.23 | 48 | 7 | 1 | 56 | 1.22 |
| Seremban, Jelebu and Coast ... | 30,257 | 3,100 | 464 | 3,564 | 117.79 | 48 | 29 | 7 | 84 | 2.78 |
| Tampin and Kuala Pilah ... ... | 19,686 | 1,680 | 865 | 2,545 | 129.28 | 48 | 64 | 12 | 124 | 6.30 |
| Pahang West ... ... ... | 8,343 | 845 | 295 | 1,140 | 137.13 | 11 | 15 | 6 | 32 | 3.85 |
| ,, East ... ... ... | 7,011 | 1,131 | 113 | 1,244 | 174.58 | 5 | 6 | — | 11 | 1.56 |
| Total ... | 212,653 | 15,545 | 2,945 | 18,490 | 86.95 | 230 | 186 | 40 | 456 | 2.14 |

## TABLE J.

### MALARIA.

### ADMISSIONS TO HOSPITAL FOR MALARIA, AND DEATHS FROM MALARIA, LABOURERS AND DEPENDANTS, ALL NATIONALITIES.

| Divisions. | Total estate population. All nationalities labour force and dependants. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | In hospital. | | Outside hospital. | | |
| | | Estate. | Govt. | Total. | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 28,827 | 710 | 280 | 990 | 34.34 | 20 | 18 | 11 | 49 | 1.70 |
| Kuala Kangsar and Upper Perak ... | 16,753 | 1,057 | 228 | 1,285 | 76.70 | 21 | 12 | 4 | 37 | 2.20 |
| Kinta ... ... ... ... | 12,092 | 809 | 253 | 1,062 | 87.82 | 14 | 23 | 6 | 43 | 3.55 |
| Lower Perak ... ... ... | 26,888 | 2,023 | 114 | 2,137 | 79.48 | 34 | 5 | 2 | 41 | 1.56 |
| Batang Padang ... ... ... | 13,854 | 828 | 112 | 940 | 67.85 | 16 | 4 | 2 | 22 | 1.59 |
| Selangor East ... ... ... | 35,074 | 2,469 | 650 | 3,119 | 88.93 | 40 | 25 | 4 | 69 | 1.96 |
| ,, Coast ... ... ... | 66,896 | 4,289 | 168 | 4,457 | 66.62 | 109 | 10 | 2 | 121 | 1.81 |
| Seremban, Jelebu and Coast ... | 34,987 | 4,235 | 607 | 4,842 | 138.39 | 67 | 49 | 12 | 128 | 3.66 |
| Tampin and Kuala Pilah ... ... | 22,195 | 2,001 | 1,027 | 3,028 | 136.43 | 64 | 92 | 22 | 178 | 8.02 |
| Pahang West ... ... ... | 9,700 | 941 | 361 | 1,302 | 134.23 | 18 | 16 | 7 | 41 | 4.23 |
| ,, East ... ... ... | 7,974 | 1,539 | 117 | 1,656 | 207.67 | 9 | 6 | — | 15 | 1.88 |
| Total ... | 275,240 | 20,901 | 3,917 | 24,818 | 90.17 | 412 | 260 | 72 | 744 | 2.70 |

### TABLE K.

### MALARIA.

### INDIAN LABOURERS ADMISSIONS TO HOSPITAL FOR MALARIA, AND DEATHS FROM MALARIA.

| Divisions. | No. of labour force Indians only. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Estate. | Govt. | Total. | | In hospital. | | Outside hospital. | | |
| | | | | | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 17,269 | 522 | 229 | 751 | 43.49 | 13 | 7 | 2 | 22 | 1.27 |
| Kuala Kangsar and Upper Perak ... | 9,876 | 919 | 171 | 1,090 | 110.37 | 11 | 7 | 4 | 22 | 2.23 |
| Kinta ... ... ... ... | 7,703 | 643 | 185 | 828 | 107.49 | 5 | 14 | 2 | 21 | 2.73 |
| Lower Perak ... ... ... | 17,502 | 663 | 26 | 689 | 39.37 | 5 | 2 | 1 | 8 | .46 |
| Batang Padang ... ... ... | 8,741 | 580 | 102 | 682 | 78.02 | 12 | 5 | 2 | 19 | 2.17 |
| Selangor East ... ... ... | 21,456 | 1,748 | 650 | 2,398 | 111.76 | 30 | 21 | 4 | 55 | 2.56 |
| ,, Coast ... ... ... | 46,795 | 4,289 | 139 | 4,428 | 94.63 | 109 | 9 | 2 | 120 | 2.56 |
| Seremban, Jelebu and Coast ... | 18,550 | 2,271 | 158 | 2,429 | 130.94 | 38 | 23 | 5 | 66 | 3.56 |
| Tampin and Kuala Pilah ... ... | 9,835 | 1,408 | 595 | 2,003 | 203.66 | 45 | 41 | 7 | 93 | 9.46 |
| Pahang West ... ... ... | 3,444 | 548 | 242 | 790 | 229.39 | 9 | 12 | 5 | 26 | 7.55 |
| ,, East ... ... ... | 1,456 | 436 | 108 | 544 | 375.62 | 2 | 6 | — | 8 | 5.49 |
| Total ... | 162,627 | 14,027 | 2,605 | 16,632 | 102.27 | 279 | 147 | 34 | 460 | [illegible] |

### Table L.

### MALARIA.

INDIAN LABOURERS AND DEPENDANTS: ADMISSIONS TO HOSPITAL FOR MALARIA, AND DEATHS FROM MALARIA.

| Divisions. | No. of labour force and dependants Indians only. | Hospital admissions. | | | Hospital admission rate. | Deaths. | | | Total deaths. | Death-rate per mille. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Estate. | Govt. | Total. | | In hospital. | | Outside hospital. | | |
| | | | | | | Estate. | Govt. | | | |
| Larut, Matang, Krian and Selama | 25,379 | 704 | 263 | 967 | 38.10 | 18 | 19 | 8 | 45 | 1.78 |
| Kuala Kangsar and Upper Perak... | 12,183 | 1,046 | 218 | 1,264 | 103.75 | 20 | 12 | 6 | 38 | 2.12 |
| Kinta ... ... ... ... | 10,340 | 809 | 253 | 1,062 | 102.77 | 14 | 23 | 6 | 43 | 4.16 |
| Lower Perak ... ... ... | 26,119 | 2,019 | 114 | 2,133 | 81.66 | 34 | 5 | 2 | 41 | 1.57 |
| Batang Padang ... ... ... | 11,795 | 788 | 117 | 905 | 76.73 | 15 | 5 | 2 | 21 | 1.86 |
| Selangor East ... ... ... | 28,365 | 2,308 | 697 | 3,005 | 105.94 | 41 | 21 | 4 | 66 | 2.56 |
| ,, Coast ... ... ... | 65,105 | 4,289 | 139 | 4,428 | 68.01 | 109 | 9 | 2 | 120 | 1.84 |
| Seremban, Jelebu and Coast ... | 23,759 | 2,925 | 284 | 3,209 | 135.06 | 57 | 38 | 9 | 104 | 4.38 |
| Tampin and Kuala Pilah ... ... | 11,941 | 1,627 | 714 | 2,341 | 196.05 | 51 | 63 | 13 | 127 | 10.64 |
| Pahang West ... ... ... | 3,637 | 586 | 222 | 808 | 222.16 | 13 | 16 | 3 | 32 | 7.13 |
| ,, East ... ... ... | 1,985 | 446 | 110 | 556 | 280.10 | 4 | 5 | — | 9 | 4.53 |
| Total ... | 220,608 | 17,547 | 3,131 | 20,678 | 93.73 | 376 | 216 | 55 | 647 | 2.93 |

### (B) Mines.

The estimated population employed in mining during the year was 104,468, as against 109,141 in 1928, a decrease of 4,673. Mines are not required to send in sickness and death returns, and the sick rates and death rates are not known. In some instances anti-malarial measures are undertaken and paid for by the owner, when a mine is adjacent to a town and a menace to health.

Visits were paid to several mines and efforts made with the co-operation of the managers to improve conditions as regards water supplies, housing and general sanitation.

### (C) Railways.

The Health Officer, Railways, reports that there were no epidemics among the staff; on "open lines" a fair number of cases of chicken-pox and measles occurred, but these gave very little trouble. A fatal case of haemorrhagic smallpox occurred in the menial staff quarters in Kuala Lumpur on 17th April; eight blocks of quarters were isolated and the occupants vaccinated. Intensive vaccination was carried out by the Health Officer, Kuala Lumpur, and no other case occurred in the vicinity. Malaria is still the chief cause of sickness and loss of time among the staff. Permanent anti-malarial works have been extended at many stations during the year, and ten oiling gangs are permanently employed. In addition to the work of these gangs, payment was made to many estates and almost all of the Mosquito Destruction Boards bordering on the Railway for oiling done in the Railway Reserve, the total cost of oil and labour being some $35,421. The number of quinine tablets issued was 195,430. The night mail trains are sprayed with an insecticide before departure and sometimes at intermediate stations. Malaria-carrying mosquitoes, which have entered the trains when halted during the night, have been caught in the carriages at Kuala Lumpur in the morning, and the question of preventing this is at present under consideration; the problem is a very difficult one as cattle, horse or pig vans are also involved.

Matters of general sanitation including latrine accommodation received close attention. A staff of four Health Inspectors and 22 Dressers in charge of Railway Dispensaries was maintained. These Dressers cover the whole line once a fortnight by trolley, visiting all stations and cooly lines on this inspection.

The health of the staff on "Construction" is reported as improving, although malaria is still common owing to the nature of the country.

### (D) Public Works Department.

As previously mentioned the Health Branch has endeavoured to keep in close touch with the Public Works Department when new works or road-making cause large numbers of coolies to be employed under unsatisfactory health conditions.

Numerous visits were paid to the cooly lines of this Department throughout the country, and recommendations forwarded when necessary, pointing out what measures, including anti-malarial work, should be taken to improve the general condition and sanitation of the lines and their surroundings.

### (E) Chenderoh Dam (Perak Hydro-Electric Company Limited).

During the year the mixed labour force employed averaged 4,600, which number was gradually being reduced towards the end of the year as the work is approaching completion. Active anti-malarial measures were continued during the year, and careful observation was kept and the incidence of malaria well controlled. Eighty-two cases of malaria with three deaths were recorded, but it is believed that only a small proportion of these cases were due to a fresh infection. The death-rate on recorded deaths was only 5.67 per mille, as against 7.60 per mille in 1928.

The camp at the dam site has its own hospital and staff, sanitary and anti-malarial gangs, and periodical visits of inspection were paid by officers of the Health Branch.

### (F) Cameron's Highlands (4,750 feet).

The average population on the Highlands, chiefly composed of those working on the road construction besides employees of the Public Works and Agricultural Departments, was 2,308, of which two-thirds were Chinese. The death-rate 12.13 per mille, shows a very slight increase over the 11.67 recorded in 1928; this is probably due to better records being kept rather than to any actual increase. Two Inspectors were stationed on the road, at Jor and Ringlet; three Hospital Dressers are stationed on the Highlands, and sanitary gangs operate at Jor, Ringlet and Tana Rata.

Extensive anti-malarial work of a temporary type was maintained throughout the year for the protection of all those employed on the road extension area. Constant surveys are carried out as a routine practice, particularly at the higher elevations, in order that the advent of potential malaria-carrying anophelines to new areas may be at once recorded.

*A. maculatus* (Theobald) breeds freely in the area traversed by the first 31 miles of road, that is up to an elevation of 3,600 feet. Higher up the road it is less often found, while after the 36th mile, constant surveys failed to recover this species until the end of the year, when it was found at the proposed recreation ground near Tana Rata (4,600 feet) in seepage water from a new road cutting; simultaneously larvæ of the same species were recovered on a tea plantation some five miles away at a slightly higher elevation. The identification of these larvæ and of some mosquitoes which hatched out was confirmed by the Entomologist.

The total expenditure on practical anti-mosquito work at the Highlands during the year amounted to $27,685.12, which figure includes cost and transport of oil, cost of oiling, maintenance of drains and cost of ditching. The success of these measures is seen by the fact that only two deaths from malaria occurred during the year, a death-rate of 0.87 per mille.

### (G) Factories.

Rules for Arsenic Refineries were drafted in view of a proposed establishment at Menglembu in Perak.

### (v) HOUSING AND TOWN PLANNING.

Since overcrowding is one of the serious problems as regards the Asiatic inhabitants in the towns, this question received much attention by the various Town Planning Committees which exist, and on each of which a Health Officer is a member.

Sanitary Boards in towns and villages, and special committees for hill stations, control lay-outs in conjunction with the Town Planning Department, and many improvements were effected upon existing conditions, with due regard to the most modern principles and future requirements in respect of housing, provision of factory areas, density of housing, recreation spaces, road widening and all proper amenities.

### (vi) FOOD IN RELATION TO HEALTH AND DISEASE.

No food epidemics are known to have occurred during the year. Food factories, bakeries, sauce factories, aerated-water factories, eating shops and coffee shops are licensed and were inspected periodically. Dairies received special attention and efforts were and are being made to improve the supply of fresh milk in towns. Under the Food and Drugs Enactment, 1913, 990 samples of milk were taken by Health and Sanitary Inspectors and examined by the Chemists at the Institute for Medical Research; 103 of these did not comply with the Enactment and the vendors were prosecuted. Prosecutions were undertaken in many cases where hawkers of food stuff were found to be unlicensed, and convictions were obtained in most cases.

Samples of toddy are usually now taken under the Excise Enactment, but the Health Branch also took a number of samples under the Food and Drugs Enactment, and where these were found adulterated, prosecutions followed and convictions were recorded.

### (vii) EDUCATION AND PROPAGANDA.

The Committee for Public Health Education carried on health propaganda by newspaper advertisements, pamphlets and circulars in the various languages giving advice in connexion with some of our common diseases. Lectures on malaria illustrated by lantern slides and on the dangers of venereal disease were given in many rural areas and were well attended. In Perak some lectures were given by Health Officers, and at all schools visited simple instruction on different health topics is now given as a routine practice. The practice of visiting the households of reported cases of pulmonary tuberculosis, referred to earlier in the report, has, by attaining the good-will of those concerned and by imparting simple advice, no doubt already accomplished some good. Work is in hand on the preparation of further appropriate films for health propaganda purposes, a film on Infant Welfare work having been shown previously to large and interested audiences. At Agri-horticultural Shows held at Taiping and Lenggong in Perak and Telok Datoh in Selangor very successful Health and Infant Welfare exhibits were included. Great interest was taken by the general public including a large number of Malay raiats, who listened attentively to the simple lectures given and watched the demonstrations with keen interest.

### (viii) TRAINING OF SANITARY PERSONNEL.

Training of the junior personnel is carried out at District Health Offices under the guidance of the Health Officers, Chief Sanitary Inspectors and Senior Sanitary Inspectors. Opportunity was taken during the year to second two Probationer Inspectors to the Entomologist at the Institute for Medical Research, who employed them in connexion with experiments in the collection of adult anophelines; a number of Probationers were also sent in turn for temporary duty to Cameron's Highlands, to obtain some experience of development and construction work and the accompanying conditions. They were also taught to carry out vaccination, and encouraged to give simple teaching and demonstration when the opportunity occurred.

Eight Probationer Inspectors of the Health Branch attended the six months' course of instruction at Singapore as laid down by the Royal Sanitary Institute, London; at the examination held in November four obtained the certificate and four obtained the Probationers' pass.

## IV.—PORT HEALTH WORK.

Port Swettenham, in Selangor, is the principal port of the Federation; other ports, which deal chiefly with local traffic, are Telok Anson in Perak, Port Dickson in Negri Sembilan and Kuantan in Pahang.

The Federated Malay States are afforded protection by three Quarantine Stations:

(*a*) The Island of Pulau Jerejak adjacent to Penang, which deals with the immigration of Indian labour for the Northern Colonial Settlement, for Perak and the Unfederated State of Kedah.

(*b*) St. John's Island close to the port of Singapore, which deals chiefly with the vast amount of immigration from Southern China to Malaya.

These two stations belong to the Straits Settlements.

(*c*) Port Swettenham is the gateway of immigration for Indian labour employed in Selangor and the adjoining portions of other States. Here, also, measures are taken to prevent the introduction and spread of infectious and contagious diseases throughout the Federation.

One must also bear in mind the quarantine station at Padang Besar on the boundary of Southern Siam and the Unfederated State of Perlis, where the railway crosses from British into Siamese territory.

At Port Swettenham, 1,431 ocean-going steamers and 1,819 local steamers arrived during the year, and a number of these were visited by an officer of the Health Branch. Owing to the proximity of Singapore in the south and Penang in the north, at which ports steamers for Port Swettenham usually also call, no disinfection of steamers is carried out at Port Swettenham, this service when necessary being carried out by agreement at one of the Colony's Ports under article 50 of the International Sanitary Convention of Paris, 1926.

Forty-nine ships bringing 56,001 immigrants and 4,735 deck passengers arrived at Port Swettenham. All ships were boarded and inspected, and the immigrants and deck passengers received into the Quarantine Camp. Six ships were infected, four with cerebro-spinal meningitis, and two with smallpox.

The Quarantine Camp, Port Swettenham, dealt with 56,026 immigrants and 4,735 deck passengers as follows:

| | Immigrants. | Deck passengers. | Total. |
|---|---|---|---|
| Remaining 31st December, 1928 ... | 25 | — | 25 |
| Arrived ... | 56,001 | 4,735 | 60,736 |
| Total ... | 56,026 | 4,735 | 60,761 |
| Discharged to depôt ... | 55,077 | 4,594 | 59,671 |
| Transferred to hospital outside ... | 153 | 6 | 159 |
| Absconded ... | 21 | — | 21 |
| Died ... | 151 | — | 151 |
| Remaining 31st December, 1929 ... | 624 | 135 | 759 |

Of the 56,001 immigrants arriving, 33,598 were adult males, 11,505 adult females, 4,142 male minors, 3,325 female minors and 3,431 infants. The average daily number of immigrants was 1,537. The largest number in one day was 5,907 on 25th May, 1929. The percentage of deaths to total arrivals was 0.26 per cent. Fifty-seven thousand two hundred and seventy-nine were vaccinated against smallpox, as follows:

| | |
|---|---|
| Immigrants ... ... ... ... ... ... ... ... | 52,989 |
| Passengers ... ... ... ... ... ... ... ... | 4,260 |
| Staff various ... ... ... ... ... ... ... | 130 |

Hookworm treatment was administered to 39,925 immigrants.

The following is a comparative statment of immigrants passed through the camp in the last three years:

| | 1927. | 1928. | 1929. |
|---|---|---|---|
| Remaining ... ... | 1,697 | 1,419 | 25 |
| Admitted ... ... ... | 80,399 | 19,840 | 56,001 |
| Total ... | 82,096 | 21,259 | 56,026 |
| Discharged ... ... | 80,296 | 21,138 | 55,077 |
| Transferred ... ... | 61 | 62 | 153 |
| Absconded ... ... | 58 | 1 | 21 |
| Died ... ... ... | 260 | 33 | 151 |
| Remaining ... ... | 1,419 | 25 | 624 |

## QUARANTINE CAMP HOSPITALS.

There are special wards for infectious and contagious diseases and general wards; there are also three two-roomed infectious disease wards for Europeans.

The statistics for the hospital are as follows:

### Infectious Disease Wards.

| | |
|---|---|
| Remaining 31st December, 1928 ... ... ... ... ... | — |
| Admitted ... ... ... ... ... ... ... ... | 190 |
| Total ... | 190 |
| Discharged ... ... ... ... ... ... ... ... | 152 |
| Died ... ... ... ... ... ... ... ... ... | 36 |
| Remaining 31st December, 1929 ... ... ... ... ... | 2 |

The diseases treated were: Cerebro-spinal meningitis, 43 cases with 36 deaths; smallpox 1; chicken-pox 13; measles 126; mumps 7. This epidemic of cerebro-spinal meningitis commenced on 2nd May, 1929 with cases brought by s.s. "Ellenga" and lasted off and on until 22nd July, 1929; the disease was of a very virulent type, and in spite of immediate active treatment the mortality was very high.

### General Wards.

ADMISSION OF PATIENTS AND DEPENDANTS.

| | Patients. | Dependants. | Total. |
|---|---|---|---|
| Remained 31st December, 1928 | 10 | 15 | 25 |
| Admitted ... ... ... ... | 1,497 | 1,209 | 2,706 |
| | 1,507 | 1,224 | 2,731 |
| Discharged ... ... ... | 1,198 | 1,193 | 2,391 |
| Transferred ... ... ... | 157 | — | 157 |
| Absconded ... ... ... ... | 7 | — | 7 |
| Died ... ... ... ... | 120 | — | 120 |
| Remaining 31st December, 1929 | 25 | 31 | 56 |

The commoner diseases treated were: Influenza, pneumonia, bronchitis, dysentery, colitis, marasmus and conjunctivitis.

The average daily number in the wards was 63. The greatest number in one day (4th June, 1929) was 195. Sixty-six were admitted from the Labour Depôt, of whom five died. The common causes of death were: Broncho-pneumonia 59, lobar pneumonia 17, marasmus 11, bacillary dysentery 9. The percentage of deaths to admissions was 8.01. Indians only were treated in the Camp Hospital.

# V.—MATERNITY AND CHILD WELFARE.

Infant Welfare Centres were maintained at Kuala Lumpur and Klang in Selangor, Ipoh and Taiping in Perak, and Seremban in Negri Sembilan. In addition the Lady Medical Officer at the District Hospital, Telok Anson, in Perak, carried out Infant Welfare work, pending the erection of a special building when the work will be transferred to the Health Branch; further work was also carried out by means of a launch by a Lady Medical Officer amongst riverine kampongs on the Perak River. A total of 161,660 patients excluding those in riverine kampongs were seen. In the five Centres, 150,239 patients received attention compared with 118,258 in 1928. The motor omnibuses attached to the Centres brought in 93,876 patients, compared with 54,472 last year. This figure shows an enormous increase, in spite of the fact that it was necessary in the second half of the year considerably to reduce the mileage done by the motor omnibuses owing to the heavy costs for maintenance.

Work at a Centre may be divided into (*a*) in-door, (*b*) out-door. Under (*a*) in-door, the work performed is ante-natal, post-natal, and also that of a women's and children's out-door dispensary. Advice is given to any pregnant women who attend the Centre, a brief examination is made and anything abnormal noted for future reference. Assistance is given by providing an obstetrical packet if required, and accommodation is arranged in hospital for those who require it. All babies on arrival at a Centre are seen by the Lady Medical Officer, are undressed and weighed. Mothers and older children are taught the elements of hygiene. Demonstrations in feeding and the preparation of food are given from a table specially fitted up for the purpose; out-door dispensary patients are dealt with, and serious cases recommended hospital treatment; if this is accepted transport is provided and an admission letter.

### (*b*) OUT-DOOR.

*Health Visiting in the Homes.*—This important part of the work has further increased during the year, no less than 116,019 visits being paid by European and Asiatic Health Visitors. The visiting is not easy and entails much walking and searching for addresses of patients, who however are highly appreciative of this side of the work and welcome the presence of the Health Visitor.

## EDUCATION AND PROPAGANDA.

A brief reference has been made earlier in this report to the Infant Welfare Exhibition at the Agri-Horticultural Shows at Taiping and Lenggong in Perak and Telok Datoh in Selangor. These exhibits were mainly divided into two groups, the first containing sections concerning the care of the baby before birth, during birth and in infancy, the second having sections of a more specialised kind referring to feeding, care of the teeth and elementary hygiene. Many exhibits and posters were displayed and explained.

The exhibitions were viewed with great interest by large crowds of all nationalities.

The summarised number of patients which attended the five Centres and the number of visits paid at the houses of patients, is shown in the table on the following page.

A. K. COSGRAVE,
*Acting Chief Health Officer.*

## MATERNITY AND CHILD WELFARE WORK DONE AT THE INFANT WELFARE CENTRES, FEDERATED MALAY STATES, DURING THE YEAR 1929.

| Nature of work. | | |
|---|---|---|
| 1. Total No. of clinics held ... ... | | 2,718 |
| 2. Total No. of attendances of mothers ... ... ... | 34,273 | |
| 3. Total No. of attendances of infants up to one year ... | 41,133 | |
| 4. Total No. of attendances of children from 1 to 12 years ... | 63,106 | |
| 5. Total No. of attendances of other cases ... ... ... | 11,727 | |
| 6. Grand total of attendances ... ... | | 150,239 |
| 7. No. of new infants attended ... ... | | 12,326 |
| 8. ,, children ,, ... ... | | 20,888 |
| 9. ,, mothers ,, ... ... | | 9,451 |
| 10. ,, other cases seen ... ... | | 5,041 |
| 11. No. of Infants—Normal, general advice given ... ... ... ... ... | | 13,701 |
| 12. No. of children—Normal, general advice given ... ... ... ... | | 5,441 |
| 13. No. of infants suffering from incorrect feeding ... ... ... ... | | 3,551 |
| 14. No. of infants suffering from malnutrition ... ... ... ... | | 1,239 |
| 15. No. of infants suffering from congenital syphilis ... ... ... ... | | 165 |
| 16. No. of infants suffering from rickets | | 179 |
| 17. No. of cases of worms— | | |
| (*a*) Women ... ... ... | | 4,844 |
| (*b*) Children ... ... ... | | 23,969 |
| 18. No. of cases of malaria— | | |
| (*a*) Women ... ... ... | | 2,753 |
| (*b*) Children ... ... ... | | 4,499 |
| 19. No. of cases of beri-beri— | | |
| (*a*) Women ... ... ... | | 361 |
| (*b*) Children .. ... ... | | 1 |
| 20. No. of cases of other diseases— | | |
| (*a*) Women ... ... ... | | 18,012 |
| (*b*) Children ... ... ... | | 32,545 |
| 21. No. of ante-natal mothers seen by Doctor ... ... ... ... | | 2,518 |
| 22. No. of post-natal mothers seen by Doctor ... ... ... ... | | 1,281 |
| 23. No. of mothers (others) seen by Doctor ... ... ... ... | | 23,416 |
| 24. No. of infants seen by Doctor ... | | 22,976 |
| 25. ,, children seen by Doctor ... | | 36,929 |
| 26. ,, infants weighed ... ... | | 25,309 |
| 27. ,, cases referred to Private Doctors | | 16 |
| 28. ,, ,, sent to hospital ... ... | | 1,694 |
| DISTRICT WORK. | | |
| 29. No. of visits paid by Sisters to— | | |
| (*a*) Expectant mothers ... ... | | 1.475 |
| (*b*) Infants... ... ... ... | | 12,425 |
| (*c*) Children aged 1 to 12 years ... | | 17,568 |
| 30. No. of visits paid by Health Visitors to— | | |
| (*a*) Expectant mothers ... ... | | 3,563 |
| (*b*) Infants ... ... ... | | 31,860 |
| (*c*) Children aged 1 to 12 years ... | | 49,128 |
| 31. No. of patients brought by transport... | | 73,876 |

| — | Monthly total of nationalities. | |
|---|---|---|
| | New cases. | Repeat cases. |
| MALAYS— | | |
| Infants ... ... | 2,204 | 6,352 |
| Children ... | 4,203 | 10,987 |
| Women ... ... | 4,209 | 9,989 |
| Total ... | 10,616 | 27,328 |
| CHINESE— | | |
| Infants ... ... | 7,394 | 15,466 |
| Children ... | 10,504 | 21,780 |
| Women ... ... | 5,341 | 13,814 |
| Total ... | 23,239 | 51,060 |
| TAMILS— | | |
| Infants ... ... | 2,237 | 5,515 |
| Children ... | 5,271 | 7,544 |
| Women ... ... | 4,033 | 5,914 |
| Total ... | 11,541 | 18,973 |
| OTHERS (Europeans, Eurasians, Bengalis, Japanese, Javanese, Siamese, etc.)— | | |
| Infants ... ... | 531 | 1.432 |
| Children ... | 910 | 1,909 |
| Women ... ... | 814 | 1,886 |
| Total ... | 2,255 | 5,227 |
| GRAND TOTAL ... | 47,651 | 102,588 |
| | =150,239 | |

NOTE.—A post-natal mother is one requiring an examination within a month or six weeks after labour with a view to detecting if unobserved injury has resulted from her confinement.

Number of miles run by buses =75,430.

# VI.—HOSPITALS, DISPENSARIES, AND SPECIAL CLINICS.

## 1.—Hospital In-Patients.

The following table shows the hospitals maintained by the Medical Department, the average daily number of patients in each, the total number of patients admitted during the year, the total number of deaths, and the death-rate per hundred admissions:

| Hospitals. | Average daily number of patients. | Total number of patients admitted. | Deaths. | Deaths per hundred admissions. |
|---|---|---|---|---|
| Perak.— | | | | |
| Ipoh Hospital | 515 | 11,775 | 962 | 8.17 |
| Taiping— | | | | |
| General Hospital | 112 | 2,954 | 219 | 7.42 |
| District Hospital | 221 | 5.391 | 398 | 7.38 |
| Batu Gajah Hospitals | 286 | 5,696 | 424 | 7.44 |
| Kuala Kangsar— | | | | |
| District Hospital | 196 | 4,007 | 282 | 7.03 |
| Malay Hospital | 33 | 1,079 | 29 | 2.68 |
| Women's Hospital | 86 | 1.586 | 137 | 8.63 |
| Tapah Hospital | 151 | 2,726 | 231 | 8.47 |
| Kampar Hospital | 177 | 3,584 | 461 | 12.86* |
| Teluk Anson Hospital | 157 | 5,142 | 377 | 7.33 |
| Tanjong Malim Hospital | 53 | 1,783 | 116 | 6.51 |
| Sungkai Hospital | 41 | 829 | 69 | 8.32 |
| Parit Buntar Hospital | 77 | 1,950 | 106 | 5.44 |
| Bagan Serai Hospital | 55 | 1,568 | 163 | 10.40 |
| Klian Intan Hospital | 21 | 459 | 37 | 8.06 |
| Grik Hospital | 13 | 400 | 35 | 8.75 |
| Sitiawan Hospital | 33 | 1,134 | 74 | 6.53 |
| Selangor.— | | | | |
| Kuala Lumpur— | | | | |
| General Hospital | 241 | 7,041 | 581 | 8.25 |
| District Hospital | 679 | 11,075 | 1,169 | 10.55 |
| Malay Hospital | 69 | 2,007 | 38 | 1.89 |
| European Hospital | 21 | 627 | 5 | 0.79 |
| Klang Hospital | 187 | 5,709 | 529 | 9.26 |
| Kajang Hospital | 156 | 3,321 | 310 | 9.33 |
| Kuala Kubu Hospital | 84 | 2,650 | 226 | 8.52 |
| Serendah Hospital | 71 | 1,521 | 177 | 11.63 |
| Kuala Selangor Hospital | 30 | 1,086 | 45 | 4.14 |
| Negri Sembilan.— | | | | |
| Seremban Hospital | 409 | 8,971 | 878 | 9.78 |
| Kuala Pilah— | | | | |
| District Hospital | 187 | 3,748 | 306 | 8.16 |
| Women's Hospital | 62 | 1,425 | 119 | 8.35 |
| Tampin Hospital | 136 | 2,495 | 220 | 8.81 |
| Port Dickson Hospital | 86 | 1,345 | 132 | 9.81† |
| Jelebu Hospital | 49 | 842 | 56 | 6.65 |
| Pahang.— | | | | |
| Kuantan Hospital | 119 | 2,422 | 142 | 5.86 |
| Bentong Hospital | 98 | 2,621 | 230 | 8.77 |
| Kuala Lipis Hospital | 96 | 2,977 | 192 | 6.44 |
| Raub Hospital | 58 | 1,709 | 133 | 7.78 |
| Mentakab Hospital | 31 | 974 | 81 | 8.32 |
| Pekan— | | | | |
| District Hospital | 12 | 215 | 12 | 5.58 |
| Women's Hospital | 4 | 114 | 4 | 6.06 |

---

Remarks.—* Two hundred and sixteen cases of pulmonary tuberculosis were transferred here from other hospitals. † Many cases of pulmonary tuberculosis were transferred here from other hospitals.

The total number of patients admitted to hospitals was 113,647, with 9,756 deaths. The corresponding figures for the previous year were 143,361 and 11,329. The decrease corresponds with the general decrease in sickness during 1929.

The existing hospital accommodation and the average daily number of in-patients, in the four States, is shown hereunder:

| | Total number of beds. | Average daily number of patients. |
|---|---|---|
| Perak | 3,056 | 2,247 |
| Selangor | 1,907 | 1,538 |
| Negri Sembilan | 1,080 | 929 |
| Pahang | 582 | 418 |
| Total | 6,625 | 5,132 |

Bearing in mind that the year was relatively healthy, it will be seen that the accommodation available is not greatly in excess of the normal demand. It is expected that the organization of hospitals for estate labourers, under the Health Boards Enactment, will relieve Government hospitals of many patients. As a result of this relief it may be possible to reduce some of the hospitals by closing down old and unsatisfactory wards, which otherwise would have to be replaced by new buildings. But most of the hospitals will have to be maintained at the present establishment, to meet the growing demand of that part of the population not resident on estates; it is also to be remembered that a number of special cases from among estate labourers are still likely to enter Government hospitals, where better facilities for special surgical or other treatment are generally available.

## 2.—Out-Patients.

The number of out-patients treated in all hospitals, dispensaries, and travelling dispensaries was reported as 878,158. The number reported during the previous year was 895,948.

The following figures show the number treated during the last four years:

| State. | 1926. | 1927. | 1928. | 1929. |
|---|---|---|---|---|
| Perak | 210,511 | 292,087 | 347,428 | 321,968 |
| Selangor | 227,864 | 286,843 | 307,449 | 316,539 |
| Negri Sembilan | 101,652 | 108,314 | 127,970 | 116,545 |
| Pahang | 90,025 | 102,520 | 113,101 | 123,106 |
| Total | 630,052 | 789,764 | 895,948 | 878,158 |

## 3.—Surgery.

This branch of hospital work still continues to develop, as is shown by the following figures for major operations performed in the four States:

| | 1928. | 1929. |
|---|---|---|
| Perak | 625 | 672 |
| Selangor | 605 | 640 |
| Negri Sembilan | 210 | 327 |
| Pahang | 23 | 32 |
| Total | 1,463 | 1,671 |

The surgical work in the three States where a Surgical Specialist was stationed is summarized in the following paragraphs:

(1) *Perak.*—Mr. T. W. H. Burne, Senior Surgeon, was in charge throughout the year. Dr. E. C. Chitty assisted in surgical work during the first part of the year, and Dr. E. S. Lawrie during the latter part. Most of the work was done at Ipoh, where 333 major operations were performed: there were 22 operations on Europeans at Batu Gajah, and 8 at Taiping. Spinal anaesthesia was employed in 102 operations at Ipoh. The new operating theatre at Ipoh was not quite ready for use at the end of the year.

(2) *Selangor.*—Mr. R. M. Dannatt, Surgeon, was in charge for the first three months, after which he went on leave and Mr. C. S. Wilson, Surgeon, acted for the rest of the year. Of the major operations performed in Kuala Lumpur, 438 were at the General Hospital, 134 at the European Hospital, and 68 at the District Hospital. The number at the European Hospital was three times the number performed in 1926, nearly double the number in 1927, and a fifty per cent. increase upon that in 1928.

The Anaesthetist, Dr. C. P. Allen, besides administering anaesthetics for major operations at the European and General Hospitals in Kuala Lumpur, gave special instruction in anaesthesia induction to selected Assistant Surgeons, and also advised on the equipment of hospitals in Selangor, Perak, and Negri Sembilan with improved anaesthetic apparatus. It is hoped that a higher standard of anaesthesia induction may thus be attained.

The rebuilding of the operating theatre at the European Hospital was completed during the year. Emergency lighting installation, to cope with temporary failure in the main current, was fitted here and in the operating theatre of the General Hospital.

(3) *Negri Sembilan.*—Mr. C. S. Wilson, Surgeon, was in charge for the first three months, when he was transferred to Kuala Lumpur. Dr. E. C. Chitty acted for the rest of the year. The number of major operations performed was nearly fifty per cent. more than the previous year. Spinal anaesthesia was employed in 86 of the major operations.

In association with the operating theatre at the General Hospital, Seremban, there is an X-Ray equipment, under the management of the hospital staff: the apparatus is not altogether satisfactory, although 1,040 examinations were made with it.

### 4.—Ophthalmology.

Special ophthalmological clinics are conducted at Ipoh, Kuala Lumpur and Taiping, and a number of beds are reserved there for ophthalmological cases. The following paragraphs summarize the work at these three places:

(1) *Ipoh.*—Dr. P. H. Hennessy, Ophthalmologist, was in charge for the first three months of the year, and Dr. G. D. Gordon for the rest of the year. The number of new cases seen was 2,700, and 468 patients were admitted to hospital. One thousand seven hundred and eighty-two of the new cases were Chinese. There were 241 cases of trachoma, and 154 of cataract. One hundred and twenty-two major operations were performed of which 80 were for cataract.

(2) *Kuala Lumpur.*—Mr. A. Viswalingam, Assistant Ophthalmologist, was in charge throughout the year. The number of out-patients seen was 4,211, and the number of patients admitted to hospital was 1,067. Of the total number of patients 2,078 were Indians, 1,331 were Malays, and 1,265 were Chinese. There were 386 cases of trachoma, and 133 of cataract. One hundred and seventy-five major operations were performed, of which 62 were for cataract. Two thousand seven hundred and fifty-seven examinations for errors of refraction were made.

(3) *Taiping.*—Mr. G. Abraham, Deputy Medical Officer, Specialist Rank, was in charge throughout the year. The number of out-patients seen was 1,145, and 89 patients were admitted to hospital. The majority of the cases were Chinese. There were 49 cases of trachoma.

### 5.—Venereal Disease Clinics.

A full account of the work of these clinics is given in the report of the Chief Medical Officer, Social Hygiene (Appendix 3).

### 6.—New Hospital Construction.

No new hospital was built during the year; but many structural additions and alterations were completed, of which the more important were as follows:

A—Perak.—

(1) Kuala Kangsar: Raja Ward.
(2) Ipoh: New Operating Theatre Block.
(3) Teluk Anson: First Class Emergency Ward; Nurses' Hostel.
(4) Sitiawan: Maternity Ward.
(5) Parit Buntar: Maternity Ward and Labour Room; new Administration Block.

B—SELANGOR.—
- (1) Kuala Lumpur—
  - (a) General Hospital:
    - (i) First Class Women's Ward;
    - (ii) Matron's Quarters;
    - (iii) New Kitchen for Second Class Patients.
  - (b) District Hospital: Additional Dressers' Quarters.
  - (c) European Hospital: New Operating Theatre.
- (2) Kajang District Hospital: New Administration Block.

C—NEGRI SEMBILAN.—
- (1) Seremban—
  - (a) General Hospital: Additional Attendants' Quarters.
  - (b) European Hospital: Water-borne Sewage System.
- (2) Tampin—
  - (i) Temporary Women's Ward.
  - (ii) New Mortuary.

D—PAHANG.—
- (1) Raub:
  - (a) Third Class Women's Ward.
  - (b) Out-patient Block.
- (2) Bentong: Two Two-storied Mosquito-proof Wards, Men's and Women's.
- (3) Temerloh: Office and Dispensary.
- (4) Mentakab:
  - (a) Operating Theatre.
  - (b) Dysentery Ward.
- (5) Kuantan:
  - (a) Medical Officer's Quarters.
  - (b) Nursing Sisters' Quarters.

## VII.—INSTITUTIONS FOR MENTAL DISEASES AND LEPROSY.

### A.—CENTRAL MENTAL HOSPITAL.

The number of admissions during the year was 983, of which 751 were males, and 232 females. Patients discharged numbered 566, and the deaths were 226. At the end of the year there were remaining 1,785 males, and 559 females, a total of 2,344: this was 128 more than the number at the beginning of the year. The net increase during the previous years was 150 in 1927, and 180 in 1928. The number of admissions exceeded the previous year's admissions by 80.

Amongst the admissions were 71 patients from Kedah and Perlis. No patients were admitted from Kelantan, owing to lack of accommodation. At the end of the year there remained 246 patients belonging to Kedah, Perlis and Kelantan.

The table on page 33 sets out the classification of diseases. The three predominant conditions among the year's admissions were confusional insanity, primary dementia, and recent melancholia. There were 101 admissions for senile dementia.

Three hundred and sixty-nine patients were discharged as cured, and 111 as "relieved". Of the total number of deaths, 54 were due to dysentery, and 37 to pulmonary tuberculosis.

Sixty-two criminal cases were admitted, compared with 31 in the previous year. Most of these were persons who had been detected in some obviously insane act, and who should have been taken to a Medical Officer in the first instance, instead of to a Magistrate.

This mistake in procedure is unfair to the patient, wastes the time of the hospital staff in attending courts all over the country, and overcrowds the criminal wards.

Two new wards were opened at the beginning of the year, and an infectious diseases ward for females was under construction during the year.

The Medical Superintendent, Dr. W. F. Samuels, was on leave for seven months of the year, his place being taken by Dr. J. P. Fitzpatrick.

| —— | Remaining at end of 1928. | | | Admitted. | | | Discharged as cured. | | | Remaining at end of 1929. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M. | F. | Total. | M. | F. | Total. | M. | F. | Total. | M. | F. | Total. |
| A.—CONGENITAL OR INFANTILE. | | | | | | | | | | | | |
| 1. Intellectual— | | | | | | | | | | | | |
| (*a*) With epilepsy ... ... ... ... | 5 | 9 | 14 | ... | 3 | 3 | ... | ... | ... | 11 | 12 | 23 |
| (*b*) Without epilepsy ... ... ... ... | 50 | 14 | 64 | 7 | 3 | 10 | ... | ... | ... | 52 | 11 | 63 |
| 2. Moral ... ... ... ... ... ... ... | | | | | | | | | | | | |
| B.—INSANITY OCCURING LATER IN LIFE. | | | | | | | | | | | | |
| 1. Insanity with epilepsy ... ... ... ... | 51 | 21 | 72 | 16 | ... | 16 | ... | ... | ... | 56 | 24 | 80 |
| 2. General paralysis of the insane ... ... ... | 45 | 5 | 50 | 30 | 5 | 35 | ... | ... | ... | 52 | 7 | 59 |
| 3. Insanity with grosser brain lesions ... ... | 7 | 3 | 10 | ... | ... | ... | ... | ... | ... | 7 | 4 | 11 |
| 4. Acute delirium ... ... ... ... ... | | | | | | | | | | | | |
| 5. Confusional insanity ... ... ... ... | 67 | 19 | 86 | 256 | 16 | 272 | 136 | ... | 136 | 162 | 8 | 170 |
| 6. Stupor... ... ... ... ... ... ... | 5 | 4 | 9 | ... | 3 | 3 | ... | 1 | 1 | ... | 2 | 2 |
| 7. Primary dementia ... ... ... ... ... | 359 | 67 | 426 | 143 | 50 | 193 | 117 | 12 | 129 | 256 | 57 | 313 |
| 8. Mania— | | | | | | | | | | | | |
| (*a*) Recent ... ... ... ... ... ... | 24 | 3 | 27 | 33 | 59 | 92 | 18 | 12 | 30 | 21 | 32 | 53 |
| (*b*) Chronic ... ... ... ... ... ... | 43 | 22 | 65 | ... | ... | ... | ... | ... | ... | 11 | 17 | 28 |
| (*c*) Recurrent ... ... ... ... ... ... | 14 | 12 | 26 | 3 | 14 | 17 | 2 | 2 | 4 | 23 | 19 | 42 |
| 9. Melancholia— | | | | | | | | | | | | |
| (*a*) Recent ... ... ... ... ... ... | 65 | 12 | 77 | 91 | 60 | 151 | 33 | 27 | 60 | 86 | 51 | 137 |
| (*b*) Chronic ... ... ... ... ... ... | 91 | 42 | 133 | ... | ... | ... | 1 | ... | 1 | 4 | 12 | 16 |
| (*c*) Recurrent ... ... ... ... ... ... | 21 | 34 | 55 | 2 | ... | 2 | 2 | 1 | 3 | 71 | 15 | 86 |
| 10. Alternating insanity ... ... ... ... ... | 28 | 6 | 34 | 1 | ... | 1 | 2 | 1 | 3 | 21 | 2 | 23 |
| 11. Delusional insanity ... ... ... ... ... | 66 | 5 | 71 | 7 | 1 | 8 | 1 | ... | 1 | 33 | 2 | 35 |
| 12. Volitional insanity ... ... ... ... ... | 5 | ... | 5 | ... | ... | ... | 1 | ... | 1 | | | |
| 13. Moral insanity ... ... ... ... ... | | | | | | | | | | | | |
| 14. Dementia— | | | | | | | | | | | | |
| (*a*) Senile ... ... ... ... ... ... | 112 | 24 | 136 | 88 | 13 | 101 | ... | ... | ... | 146 | 35 | 181 |
| (*b*) Secondary ... ... ... ... ... ... | 663 | 188 | 851 | ... | ... | ... | ... | ... | ... | 764 | 248 | 1,012 |
| 15. Not insane ... ... ... ... ... ... | ... | ... | ... | 8 | 1 | 9 | ... | ... | ... | 2 | 1 | 3 |
| 16. Under observation, etc. ... ... ... ... | 5 | 1 | 6 | 7 | 1 | 8 | ... | ... | ... | 6 | ... | 6 |
| | 1,726 | 491 | 2,217 | 692 | 229 | 921 | 313 | 56 | 369 | 1,784 | 559 | 2,343 |

## B.—LEPER SETTLEMENTS.

### 1.—Federal Leper Settlement, Kuala Lumpur.

Dr. C. R. Amies was in charge for the first eight months of the year, and Dr. H. M. Nevin for the rest of the year. Both these officers were on the staff of the Institute for Medical Research, their work at the Leper Settlement being part-time only. Except for an Assistant Medical Officer from the staff of the District Hospital, who was employed on part-time duty, and a squad of twenty guards, the rest of the staff consisted of leper patients. The number of patients employed in various duties was 72.

Owing to the serious state of overcrowding, it was necessary to erect ten new wards of a temporary nature; these provided accommodation for 140 patients.

There were 269 admissions during the year, but of these, 32 were re-admissions of patients who had absconded, making the total of new cases 237. There were 71 deaths.

No patient was discharged as cured, but those who were bacteriologically negative were kept under observation, pending the time when the removal of the Settlement to Sungei Buloh will allow of their segregation from the other lepers, preliminary to discharge.

Treatment.—(1) The classical Chinese Tai Foong Chee treatment was used by 250 patients: about fifty per cent. have shown slight improvement after a prolonged course.

(2) One hundred and twenty-seven patients received injections (to a total number of 2,400) of "E.C.C.O.": of these, five were much improved, 28 improved, 84 remained stationary, and 10 became worse.

(3) "Alepol" was administered to 105 patients: of these, three were much improved, 21 improved, 10 slightly improved, 60 remained stationary, and 11 became worse.

(4) "Lopion" was tried on 12 cases, and the trial was continuing at the end of the year.

(5) Sodium gynocardate emulsion was administered by mouth to 32 patients; 15 of these showed slight improvement after nine months' continuous treatment.

Children born in the Settlement are removed to a special ward at the General Hospital, Kuala Lumpur.

The patients are kept as fully occupied as possible in the various trades, occupations and recreations, and are, on the whole, contented and cheerful. During the year there was an attempt to stir up trouble by a few bad characters, but this was suppressed by confining the principal agitators.

The total number of patients in the Settlement at the end of the year was 983, of which 792 were Chinese.

### 2.—Malay Leper Settlement, Pulau Pangkor Laut.

There were ten admissions to the Settlement during the year, and eight deaths. The total number of those remaining at the end of the year was 57.

Tai Foong Chee treatment was continued, and some patients were treated with "Alepol", but satisfactory treatment is difficult owing to the disclination of the Malays to persevere for any prolonged period. There are two patients apparently cured, but these refuse to be discharged.

The Settlement is visited regularly by the Medical Officer from Teluk Anson.

# VIII.—GAOLS AND DECREPIT ASYLUM.

## A.—GAOLS.

The following table shows the number of patients treated at the various gaols, with the number of deaths, for the last two years:

| Gaol. | 1928. Cases. | 1928. Deaths. | 1928. Deaths per 100 cases. | 1929. Cases. | 1929. Deaths. | 1929. Deaths per 100 cases. |
|---|---|---|---|---|---|---|
| Pudu (Kuala Lumpur) | 129 | — | — | 163 | — | 3.06 |
| Taiping | 235 | 8 | 3.40 | 130 | 5 | 3.84 |
| Batu Gajah | 229 | 4 | 1.75 | 153 | — | — |
| Seremban | 233 | 2 | 0.85 | 133 | 1 | 0.75 |
| Kuala Lipis | 39 | 1 | 2.56 | 36 | — | — |
| Kuantan | 31 | — | — | 44 | — | — |
| Total | 896 | 15 | 1.67 | 659 | 11 | 1.67 |

## B.—CHINESE DECREPIT ASYLUM, PORT SWETTENHAM.

The number of decrepits at the beginning of the year was 167: there were only two admissions, nine were transferred or absconded, nine died, and the number remaining at the end of the year was 151.

# IX.—RADIOLOGICAL BRANCH.

Dr. C. F. Constant, Radiologist, was in charge from 12th January, when he returned from leave, until the end of the year. Dr. F. G. Greenwood, Second Radiologist, went on leave in September, his place at Ipoh being taken by Dr. J. J. O'Grady.

The work done may be summarized as follows:

| | Kuala Lumpur. | Ipoh. | Total. |
|---|---|---|---|
| X-Ray examinations | 1,696 | 1,269 | 2,965 |
| Treatments | 2,179 | 350 | 2,529 |

A new building at the General Hospital, Ipoh, is under construction. This will be adjacent to the operating theatre, and will contain the accommodation lacking in the unsuitable old room, viz., waiting room, undressing room and treatment room, as well as a modern type of X-Ray room with photographic annexe.

A special dental X-Ray outfit has been installed at Kuala Lumpur. This is proving of great service, and the numerous dental cases can now be examined at the same time as general cases, whereas previously much time was lost in adjusting and readjusting the main apparatus for dental work.

The semi-portable X-Ray equipment, previously unsatisfactory, has been rebuilt to suit the local conditions and is at the General Hospital, Kuala Lumpur. The Radiologist's staff have constructed an entirely new semi-portable apparatus out of spare parts and this is at the European Hospital, where it works extremely well. These sets can be transported to any hospitals where there are cases unable to be moved from the ward.

A serial X-Ray unit for stomach work, and complete ultra-violet apparatus and a "Multiple Wave" instrument for galvanic and sinusoidal current treatment, have been installed at Ipoh, where the equipment is now the same at Kuala Lumpur.

## X.—MEDICAL RESEARCH.

At the Institute for Medical Research a full programme of research work was undertaken. Investigations in malaria included study of the conditions which may influence the infectivity of human subjects, especially with regard to the effect of treatment with quinine. Field and laboratory experiments in the breeding and life history of mosquitoes were continued. Further investigations into the aetiology of tropical typhus were carried out by the Research Student specially employed for this purpose. Other research included leprosy, leptospirosis, anaemia and pneumonia.

In addition to research, the Institute dealt with a great volume of routine bacteriological, pathological, chemical and entomological work. During the year arrangements were made for the preparation and supply of vaccine lymph; it is expected that in 1930 the Institute will be able to provide all the lymph required for smallpox vaccination in Malaya.

A full account of the work of the Institute will be found in the Annual Report, attached to this report as Appendix 1.

Clinical investigation by Medical Officers of the department included observations on the effect of subcutaneous injection of oxygen in pneumonia, which has been already mentioned, and a study of a series of cases of anaemia in pregnant women, which were carried out at the Women's Hospital at Kuala Kangsar. Several clinical articles by officers of the department were published during the year in the *Malayan Medical Journal.*

## APPENDICES.

The following appendices are attached to this report:

1.—Report of the Director, Institute for Medical Research.

2.—Report of the Registrar-General of Births and Deaths.

3.—Report of the Chief Medical Officer, Social Hygiene.

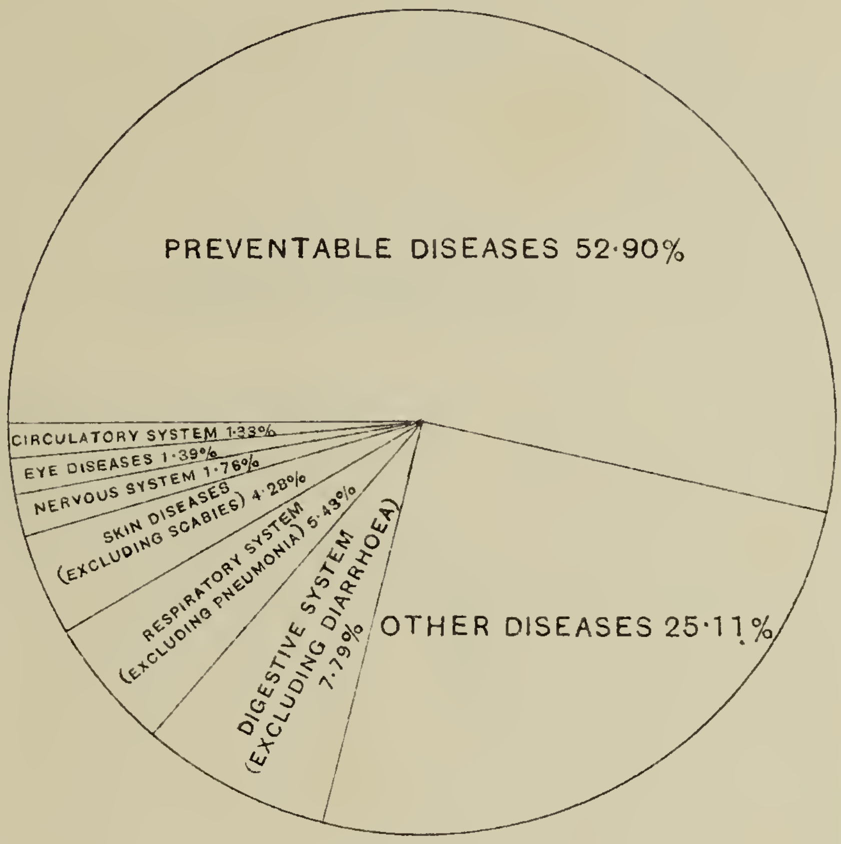
4.—Report on the Veterinary Services.

Kuala Lumpur, F.M.S.,
*May, 1930.*

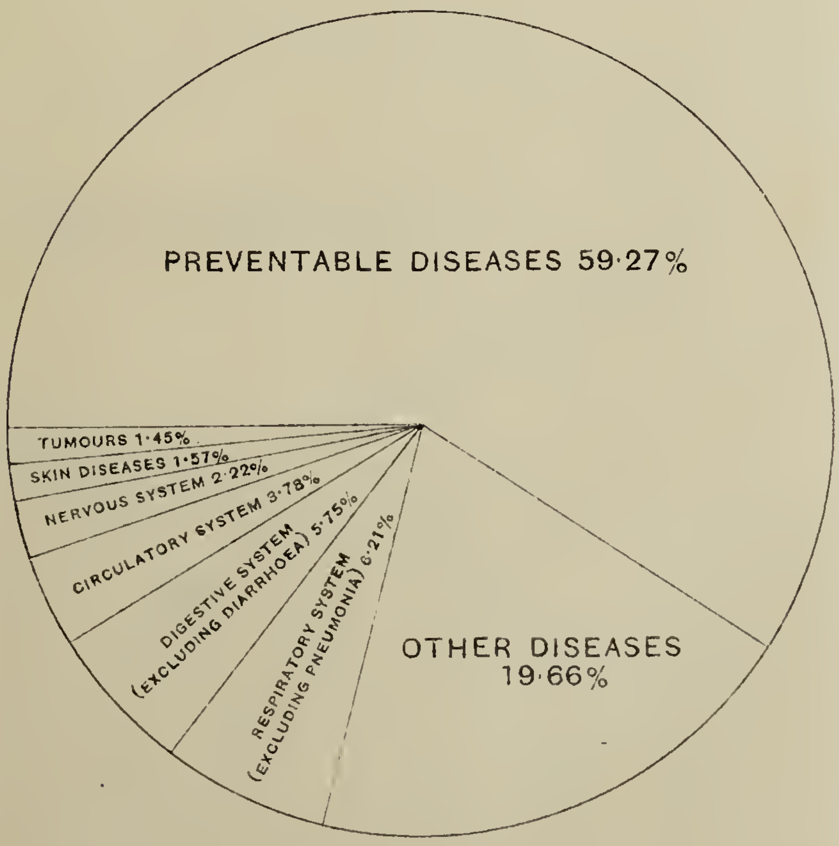
CHRISTOPHER J. WILSON,
*Principal Medical Officer, F.M.S.*

# GENERAL, SYSTEMIC & PREVENTABLE DISEASES

## TOTAL CASES ADMITTED TO HOSPITALS AS IN TABLE III - 113,647



## TOTAL DEATHS AMONGST THE CASES ADMITTED TO HOSPITALS AS IN TABLE III - 9,756



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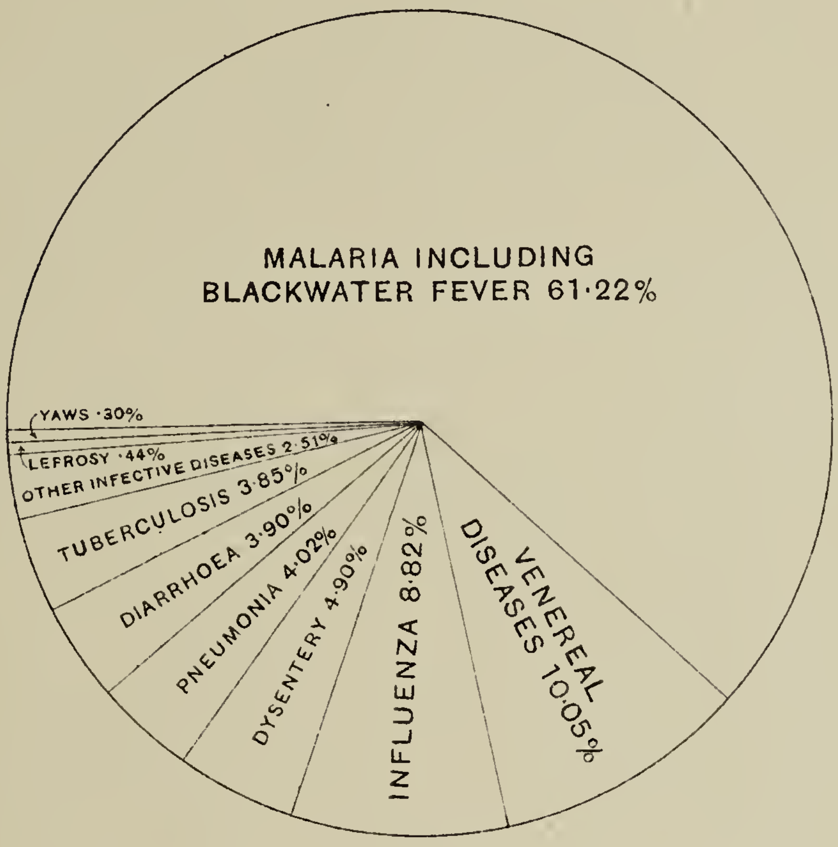
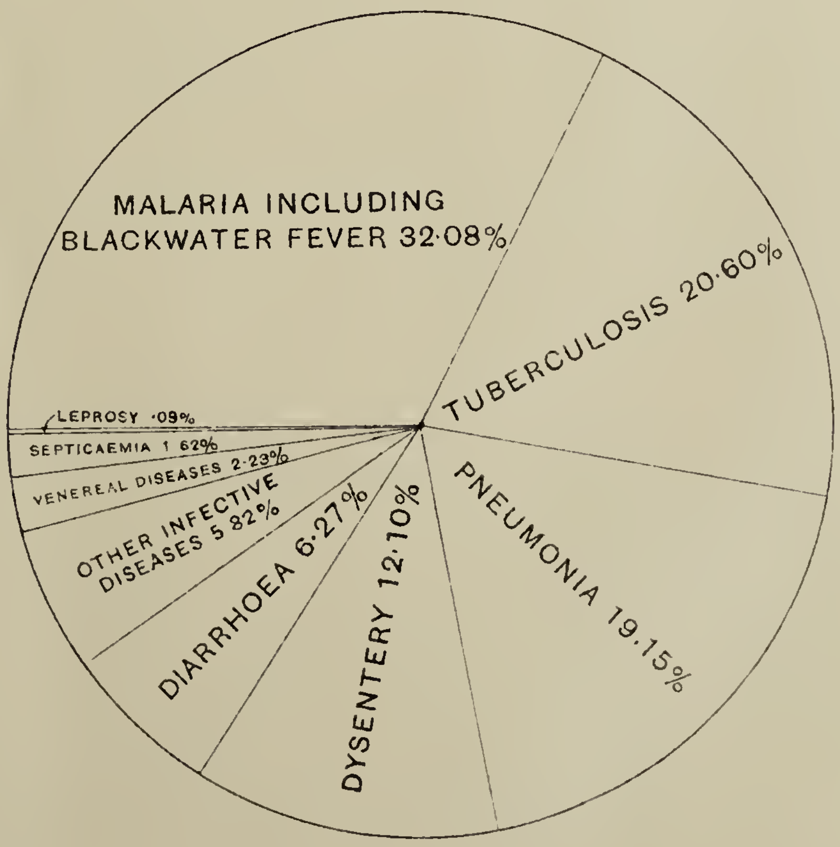
# INFECTIVE DISEASES

TOTAL CASES ADMITTED TO HOSPITALS AS IN TABLE III - 57,636



TOTAL DEATHS AMONGST THESE CASES OF INFECTIVE DISEASES - 5,595



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## Table I.

## STAFF OF THE MEDICAL DEPARTMENT ON 31st DECEMBER, 1929.

Principal Medical Officer.

Personal Assistant to the Principal Medical Officer.

### MEDICAL BRANCH.

4 Senior Medical Officers

1 Senior Surgeon

2 Surgeons

1 Ophthalmologist

1 Anaesthetist

29 Medical Officers

9 Lady Medical Officers

2 Pharmaceutical Chemists

11 Deputy Medical Officers

12 Assistant Medical Officers

43 Assistant Surgeons

1 Staff Assistant, European Hospital, Kuala Lumpur

24 Dressers, Special Grade (including 1 as Dispenser at an Infant Welfare Centre)

74 Dressers Grade I

239 Dressers Grade II (including 2 as Dispensers at Infant Welfare Centres)

116 Dressers Grade III

110 Probationer Dressers

4 Matrons Grade I

8 Matrons Grade II (including 1 at an Infant Welfare Centre)

68 European Nursing Sisters (including 7 at Infant Welfare Centres)

126 Asiatic Nurses (including 19 at Infant Welfare Centres)

22 Native Midwives (including 1 at an Infant Welfare Centre)

### HEALTH BRANCH.

Chief Health Officer

3 Senior Health Officers

17 Health Officers

3 Lady Medical Officers at Infant Welfare Centres

2 Lady Medical Inspectors of Schools

1 Dental Surgeon

2 Chief Sanitary Inspectors

1 European Steward at the Quarantine Camp, Port Swettenham

4 Assistant Surgeons

1 Special Grade Dresser

4 Senior Health Inspectors, Grade II

19 Health Inspectors Grade I

18 Health Inspectors Grade II

19 Probationers

### INSTITUTE FOR MEDICAL RESEARCH

Director
1 Bacteriologist
2 Pathologists
1 Chief Chemist
3 Chemists
1 Entomologist
2 Malaria Research Officers
1 Research Student in Tropical Medicine
1 Deputy Medical Officer, Specialist Rank
1 Assistant Medical Officer
1 Assistant Surgeon
1 Librarian
1 Laboratory Assistant Special Grade
1 Laboratory Assistant Grade I
4 Laboratory Assistants Grade II
7 Laboratory Assistants Grade III
4 Probationers
1 Storekeeper

### CENTRAL MENTAL HOSPITAL.

Medical Superintendent
2 Assistant Medical Superintendents
4 European Male Nurses
4 European Nursing Sisters
1 Senior Assistant Physician
3 Assistant Physicians
1 Inspector
1 Assistant Inspector
1 Dresser Grade I
1 Dresser Grade II
3 Dressers Grade III
1 Matron
1 Work Mistress
3 Nurses
1 Steward

### RADIOLOGICAL BRANCH

Radiologist
1 Second Radiologist
1 Lady Assistant
1 X-Ray Assistant Grade II
1 X-Ray Assistant Grade III
2 Probationers

### SOCIAL HYGIENE BRANCH.

Chief Medical Officer
5 Assistant Surgeons
3 Dressers Grade II
2 Dressers Grade III
4 Nurses

### VETERINARY BRANCH.

7 Veterinary Surgeons
7 Assistant Veterinary Surgeons
10 Veterinary Inspectors
7 Veterinary Assistants
2 Veterinary Probationers

# STAFF CHANGES DURING THE YEAR 1929.

## I.—SENIOR STAFF.

### Promotions and Appointments.

Mr. T. W. H. Burne, Surgeon, was promoted to Senior Surgeon, with effect from 1st August, 1928.

Mr. C. S. Wilson, Medical Officer, was appointed as Surgeon, with effect from 1st August, 1928.

Dr. E. C. Chitty, Medical Officer, acted as Surgeon, Negri Sembilan, from 10th April, 1929, until the end of the year.

Dr. E. H. Black, Health Officer, was promoted to Senior Health Officer, Negri Sembilan, with effect from 24th October, 1927.

Dr. E. R. C. Cooke, Health Officer, was appointed Chief Medical Officer, Social Hygiene, with effect from 1st September, 1928.

Dr. P. H. Martin, Pathologist, Institute for Medical Research, acted as Bacteriologist, from 24th June, 1929, until the end of the year.

Dr. R. Lewthwaite, Research Student, was appointed Pathologist II, with effect from 1st January, 1929, and acted as Pathologist I from 24th June, 1929, until the end of the year.

Dr. L. Anigstein was appointed Research Student in Tropical Medicine on 26th April, 1929.

Dr. R. T. B. Green, Pathologist II, was appointed Malaria Research Officer I, with effect from 1st January, 1929.

Dr. C. R. Amies, Medical Officer, was appointed Malaria Research Officer II, with effect from 22nd July, 1929.

Dr. H. M. Nevin, Medical Officer, acted as Pathologist II from 26th August, 1929, until the end of the year.

Dr. J. P. Fitzpatrick, Medical Officer, acted as Medical Superintendent, Central Mental Hospital, from 3rd May, 1929, until 3rd December, 1929, during the absence on leave of Dr. W. F. Samuels.

Dr. E. G. Morris, Medical Officer, acted as Assistant Medical Superintendent, Central Mental Hospital, from 1st January, 1929, to 31st July, 1929.

The following new appointments were made:

Dr. (Miss) E. M. Turner as Lady Medical Inspector of Schools on 7th March, 1929.

Dr. A. G. Badenoch as Medical Officer on 19th September, 1929.

Dr. A. W. H. Smith as Assistant Medical Superintendent, Central Mental Hospital, on 18th October, 1929.

Mr. C. F. Mummery as Dental Surgeon on 1st July, 1929.

### Transfers, Retirements and Resignations.

Mrs. K. M. Isaac (née Hyslop), Lady Medical Officer, was re-transferred to Kedah on 22nd March, 1929.

Dr. (Mrs.) M. E. Hopkins, Lady Medical Officer, resigned on 21st July, 1929, after being re-engaged on 1st May, 1929.

Dr. H. O. Hopkins, Malaria Research Officer, Institute for Medical Research, was transferred to the Straits Settlements Medical Department on 22nd July, 1929.

Dr. E. B. Jones, Medical Officer, resigned on 18th January, 1929.

Dr. (Mrs.) L. M. Bush, Lady Medical Officer, resigned on 28th April, 1929.

Dr. (Mrs.) C. V. Burne, Lady Medical Officer, terminated her engagement on 21st January, 1929.

Dr. (Mrs.) E. Chitty, Lady Medical Officer, resigned on 11th May, 1929.

## II.—EUROPEAN NURSING SISTERS STAFF.

### Promotions and Appointments.

Miss M. Begg, Matron Grade II, was promoted to Matron Grade I, on 16th July, 1929.

Miss S. A. Taylor, Nursing Sister, was promoted to Matron Grade II, on 16th July, 1929.

The following new appointments as European Nursing Sisters were made:

Miss M. P. Morgan on 3rd January, 1929.
Miss M. A. Colbert on 25th January, 1929.
Miss H. V. Fisher on 1st March, 1929.
Miss B. Brown on 19th April, 1929.
Miss K. W. Lupton on 2nd May, 1929.
Miss D. Westmacott on 24th May, 1929.
Miss E. M. Colville on 30th May, 1929.
Miss M. M. Poulson on 30th May, 1929.
Miss E. M. Stanley on 30th May, 1929.
Miss I. B. Stone on 30th May, 1929.
Miss L. Day on 14th June, 1929.
Miss D. Clarke on 12th July, 1929.
Miss M. N. Preece on 12th July, 1929.
Miss J. Quinn on 12th July, 1929.
Miss E. M. Smith on 12th July, 1929.
Miss H. M. Howe on 25th July, 1929.
Miss R. Waring on 25th July, 1929.
Miss M. Timmins on 9th August, 1929.
Miss N. E. Stafford on 22nd August, 1929.
Miss E. Howard on 6th September, 1929.
Miss A. M. G. Young on 6th September, 1929.
Miss D. V. Bedford on 4th October, 1929.
Miss K. A. Wickson on 18th October, 1929.
Miss A. M. Behan on 20th October, 1929.
Miss H. M. Hobbs on 20th October, 1929.

### RETIREMENTS AND RESIGNATIONS.

Miss E. Rogerson, Matron Grade I, retired on pension on 16th July, 1929.

Miss F. B. Pearn, Matron Grade I, retired on pension on 20th July, 1929.

Miss A. L. Wispler, Matron Grade II, retired on pension on 24th October, 1929.

Miss E. M. Ditcham, Nursing Sister, retired on medical grounds on 23rd January, 1929.

Miss M. L. Wardell, Nursing Sister, retired on medical grounds on 1st February, 1929.

Miss L. D. Leggatt, Nursing Sister, retired upon the termination of her agreement on 23rd August, 1929.

Miss C. M. Saunders, Nursing Sister, retired upon the termination of her agreement on 3rd November, 1929.

Mrs. C. S. Wilson, Nursing Sister, retired upon the termination of her agreement on 16th November, 1929.

Miss M. A. S. Leslie, Nursing Sister, resigned on 9th April, 1929.

Miss H. N. Shambrook, Nursing Sister, resigned on 2nd December, 1929.

Miss R. I. Potter, Nursing Sister, resigned on 30th December, 1929.

## III.—LOCALLY APPOINTED STAFF.

### APPOINTMENTS.

Mr. A. Viswalingam, Deputy Medical Officer, assumed the title of Assistant Ophthalmologist, with effect from 1st April, 1929.

The following new appointments as Assistant Surgeons were made:

Mr. Lim Eng Cheang on 15th April, 1929.
Mr. A. W. Moreira on 20th April, 1929.
Inche Nazamuddin Ahmad bin Jalaluddin Ahmad on 1st May, 1929.
Mr. Lai Nyen Soon on 1st October, 1929.

### RETIREMENTS AND RESIGNATIONS.

Mr. Gurmukh Singh retired on medical grounds on 30th December, 1929.

Mr. E. F. P. Noronha, Assistant Surgeon, resigned on 4th August, 1929.

Mr. Png Leong San, Assistant Surgeon, resigned on 1st September, 1929.

## Table II.

## STATEMENT OF REVENUE AND EXPENDITURE UNDER PERSONAL EMOLUMENTS AND OTHER CHARGES, 1929.

| Expenditure detailed. | Expenditure. | | |
|---|---|---|---|
| | | Other Charges. | |
| | Personal Emoluments. | Annually Recurrent. | Special Expenditure. |
| | $ c. | $ c. | $ c. |
| 1. Principal Medical Officer, Federated Malay States | 48,361 55 | 273,054 72 | 10,637 70 |
| 2. Radiologist, Federated Malay States | 29,341 14 | 19,022 62 | 9,672 00 |
| 3. Director, Institute for Medical Research, Federated Malay States | 168,576 22 | 58,447 71 | 3,955 24 |
| 4. Chief Medical Officer, Social Hygiene, Federated Malay States | 35,078 49 | 9,888 78 | — |
| 5. Dental Clinic | 4,292 25 | — | 4,871 40 |
| 6. College of Medicine, Singapore | — | 5,224 45 | 556 00 |
| 7. Superintendent, Central Mental Hospital, Tanjong Rambutan | 91,214 86 | 347,227 18 | 2,403 09 |
| 8. Senior Medical Officer, Perak | 1,965,665 20 | 759,454 59 | 84,263 90 |
| 9. Senior Medical Officer, Selangor | | 564,924 32 | 15,088 07 |
| 10. Senior Medical Officer, Negri Sembilan | | 340,063 00 | 12,579 64 |
| 11. Senior Medical Officer, Pahang | | 222,022 04 | 11,684 18 |
| 12. Chief Health Officer, Federated Malay States | 443,181 90 | 139,996 80 | 8,573 08 |
| 13. Infant Welfare Centres | 75,035 05 | 55,088 20 | 2,196 28 |
| 14. Veterinary Branch | 124,357 10 | 36,906 82 | 279 96 |

| | Revenue for 1929. Hospital fees, licences, etc. |
|---|---|
| 1. Principal Medical Officer, Federated Malay States | $ 2,063 50 |
| 2. Radiologist, Federated Malay States | 14,442 75 |
| 3. Director, Institute for Medical Research, Federated Malay States | 10,913 86 |
| 4. College of Medicine, Singapore | 655 00 |
| 5. Superintendent, Central Mental Hospital, Tanjong Rambutan | 61,333 80 |
| 6. Senior Medical Officer, Perak | 131,102 86 |
| 7. Senior Medical Officer, Selangor | 113,384 00 |
| 8. Senior Medical Officer, Negri Sembilan | 80,819 84 |
| 9. Senior Medical Officer, Pahang | 22,315 03 |
| 10. Chief Health Officer, Federated Malay States | 4,428 64 |

## Table III.

### THE ANNUAL RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS FOR THE YEAR 1929 (EXCLUDING THE CENTRAL MENTAL HOSPITAL, THE LEPER SETTLEMENTS AND THE PORT SWETTENHAM QUARANTINE CAMP HOSPITAL).

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| I.—Epidemic, Endemic, and Infectious Diseases. | | | | | | |
| 1. Enteric group— | | | | | | |
| (*a*) Typhoid fever | 12 | 196 | 53 | 208 | 15 | |
| (*b*) Paratyphoid A. | ... | 37 | 4 | 37 | 1 | |
| (*c*) Paratyphoid B. | 1 | 18 | 2 | 19 | ... | |
| (*d*) Paratyphoid C. | ... | 1 | ... | 1 | ... | |
| (*e*) Type not defined | ... | 9 | ... | 9 | ... | |
| 2. Typhus (Tropical) | 2 | 166 | 11 | 168 | 13 | |
| 3. Relapsing fever | ... | ... | ... | ... | ... | |
| 4. Undulant fever | ... | 1 | 1 | 1 | ... | |
| 5. Malaria— | | | | | | |
| (*a*) Tertian | 230 | 7,620 | 184 | 7,850 | 217 | |
| (*b*) Quartan | 27 | 992 | 32 | 1,019 | 34 | |
| (*c*) Aestivo—autumnal | 315 | 15,460 | 1,040 | 15,775 | 354 | |
| (*d*) Mixed infection | 11 | 722 | 81 | 733 | 27 | |
| (*e*) Undefined microscopically | 44 | 4,800 | 182 | 4,844 | 157 | |
| (*f*) Cachexia | 209 | 5,664 | 267 | 5,873 | 103 | |
| 5A. Black-water fever | 1 | 26 | 9 | 27 | ... | |
| 6. Smallpox | ... | 8 | 1 | 8 | ... | |
| Alastrim | ... | ... | ... | ... | ... | |
| 7. Measles | 3 | 171 | 3 | 174 | 6 | |
| 8. Scarlet fever | ... | 1 | ... | 1 | ... | |
| 9. Whooping cough | 3 | 47 | 2 | 50 | 1 | |
| 10. Diphtheria | 2 | 96 | 26 | 98 | 2 | |
| 11. Influenza | 71 | 5,085 | 42 | 5,156 | 81 | |
| 12. Miliary fever | ... | ... | ... | ... | ... | |
| 13. Mumps | 7 | 72 | ... | 79 | 2 | |
| 14. Cholera | ... | ... | ... | ... | ... | |
| 15. Epidemic diarrhœa | ... | ... | ... | ... | ... | |
| 16. Dysentery— | | | | | | |
| (*a*) Amœbic | 83 | 1,098 | 224 | 1,181 | 58 | |
| (*b*) Bacillary | 50 | 1,339 | 453 | 1,389 | 68 | |
| (*c*) Undefined or due to other causes | 19 | 392 | 68 | 411 | 16 | |
| 17. Plague— | | | | | | |
| (*a*) Bubonic | ... | ... | ... | ... | ... | |
| (*b*) Pneumonic | ... | ... | ... | ... | ... | |
| (*c*) Septicæmic | ... | ... | ... | ... | ... | |
| (*d*) Undefined | ... | ... | ... | ... | ... | |
| 18. Yellow fever | ... | ... | ... | ... | ... | |
| 19. Spirochætosis (Leptospirosis) | ... | 28 | 15 | 28 | ... | |
| 20. Leprosy | 5 | 251 | 5 | 256 | ... | 251 were transferred to Leper Settlement. |
| 21. Erysipelas | 3 | 91 | 16 | 94 | 5 | |
| 22. Acute poliomyelitis | ... | 2 | 1 | 2 | ... | |
| 23. Encephalitis lethargica | ... | 6 | 3 | 6 | ... | |
| 24. Epidemic cerebro-spinal fever | ... | 24 | 15 | 24 | 2 | |
| 25. Other epidemic diseases— | | | | | | |
| (*a*) Rubeola (German measles) | ... | 6 | ... | 6 | ... | |
| (*b*) Varicella (chicken-pox) | 4 | 192 | ... | 196 | 5 | |
| (*c*) Kala-azar | ... | 1 | 1 | 1 | ... | |
| (*d*) Phlebotomus fever | ... | ... | ... | ... | ... | |
| (*e*) Dengue | 2 | 58 | ... | 60 | ... | |
| (*f*) Epidemic dropsy | ... | ... | ... | ... | ... | |
| (*g*) Yaws | 18 | 176 | ... | 194 | 7 | |
| (*h*) Trypanosomiasis | ... | ... | ... | ... | ... | |

TABLE III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| I.—EPIDEMIC, ENDEMIC, AND INFECTIOUS DISEASES—(*cont.*) | | | | | | |
| 26. Glanders | ... | ... | ... | ... | ... | |
| 27. Anthrax | ... | ... | ... | ... | ... | |
| 28. Rabies | ... | 3 | 3 | 3 | ... | |
| 29. Tetanus | 1 | 89 | 63 | 90 | 1 | |
| 30. Mycosis | ... | 2 | ... | 2 | ... | |
| 31. Tuberculosis, pulmonary and laryngeal | 182 | 2,006 | 1,078 | 2,188 | 203 | |
| 32. Tuberculosis of the meninges or central nervous system | ... | 24 | 21 | 24 | ... | |
| 33. Tuberculosis of the intestines or peritoneum | 1 | 34 | 29 | 35 | ... | |
| 34. Tuberculosis of the vertebral column | 1 | 20 | 3 | 21 | 2 | |
| 35. Tuberculosis of bones and joints | 10 | 49 | 11 | 59 | 7 | |
| 36. Tuberculosis of other organs— | | | | | | |
| (*a*) Skin or subcutaneous tissue (lupus) | ... | 2 | ... | 2 | ... | |
| (*b*) Bones | ... | 1 | 1 | 1 | ... | |
| (*c*) Lymphatic system | 2 | 49 | 3 | 51 | 5 | |
| (*d*) Genito-urinary | ... | 1 | ... | 1 | ... | |
| (*e*) Other organs | ... | 9 | 1 | 9 | 1 | |
| 37. Tuberculosis disseminated— | | | | | | |
| (*a*) Acute | ... | 2 | 1 | 2 | ... | |
| (*b*) Chronic | ... | 9 | 5 | 9 | ... | |
| 38. Syphilis— | | | | | | |
| (*a*) Primary | 69 | 1,460 | ... | 1,529 | 88 | |
| (*b*) Secondary | 120 | 1,188 | 33 | 1,308 | 83 | |
| (*c*) Tertiary | 86 | 542 | 52 | 628 | 77 | |
| (*d*) Hereditary | 1 | 59 | 26 | 60 | 1 | |
| (*e*) Period not indicated | 2 | 72 | 7 | 74 | 4 | |
| 39. Soft chancre | 22 | 623 | ... | 645 | 41 | |
| 40. A.—Gonorrhœa and its complications | 63 | 1,479 | 5 | 1,542 | 102 | |
| B.—Gonorrhœal ophthalmia | 9 | 103 | 1 | 112 | 11 | |
| C.—Gonorrhœal arthritis | 10 | 244 | 1 | 254 | 12 | |
| D.—Granuloma venereum | 1 | 22 | ... | 23 | 1 | |
| 41. Septicæmia | ... | 121 | 91 | 121 | 1 | |
| 42. Other infectious diseases— | | | | | | |
| Trypanosomiasis | ... | ... | ... | ... | ... | |
| Tsutsugamushi fever | ... | 2 | ... | 2 | ... | |
| II.—GENERAL DISEASES NOT MENTIONED ABOVE. | | | | | | |
| 43. Cancer or other malignant tumours of the buccal cavity | ... | 13 | 11 | 13 | 1 | |
| 44. Cancer or other malignant tumours of the stomach or liver | 2 | 72 | 52 | 74 | 4 | |
| 45. Cancer or other malignant tumours of the peritoneum intestines, rectum | ... | 21 | 17 | 21 | 1 | |
| 46. Cancer or other malignant tumours of the female genital organs | 3 | 57 | 19 | 60 | 2 | |
| 47. Cancer or other malignant tumours of the breast | ... | 16 | 1 | 16 | 1 | |
| 48. Cancer or other malignant tumours of the skin | 1 | 29 | 9 | 30 | 1 | |
| 49. Cancer or other malignant tumours of organs not specified | 6 | 90 | 27 | 96 | 12 | |
| 50. Tumours non-malignant | 7 | 171 | 5 | 178 | 3 | |
| 51. Acute rheumatism | 4 | 136 | 3 | 140 | 5 | |

TABLE III—(*cont.*)

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| **II.—GENERAL DISEASES NOT MENTIONED ABOVE—(*cont.*)** | | | | | | |
| 52. Chronic rheumatism ... ... ... ... | 4 | 206 | 7 | 210 | 5 | |
| 53. Scurvy (including Barlow's disease) ... ... | 1 | 8 | 1 | 9 | ... | |
| 54. Pellagra ... ... ... ... ... ... ... | ... | 1 | ... | 1 | ... | |
| 55. Beri-beri ... ... ... ... ... ... ... | 283 | 1,637 | 197 | 1,920 | 269 | |
| 56. Rickets ... ... ... ... ... ... ... | 2 | 9 | 2 | 11 | 1 | |
| 57. Diabetes (not including insipidus) ... ... | 7 | 109 | 14 | 116 | 4 | |
| 58. Anæmia— | | | | | | |
| (*a*) Pernicious ... ... ... ... ... | 8 | 22 | 10 | 30 | 2 | |
| (*b*) Other anæmias and chlorosis ... ... | 55 | 1,323 | 376 | 1,378 | 57 | |
| 59. Diseases of the pituitary body ... ... ... | ... | ... | ... | ... | ... | |
| 60. Diseases of the thyroid gland— | | | | | | |
| (*a*) Exophthalmic goitre ... ... ... | ... | 3 | ... | 3 | ... | |
| (*b*) Other diseases of the thyroid gland, myxœdema ... ... ... ... | ... | 7 | 2 | 7 | ... | |
| 61. Diseases of the para-thyroid glands ... ... | ... | 1 | 1 | 1 | ... | |
| 62. Diseases of the thymus ... ... ... ... | ... | 1 | 1 | 1 | ... | |
| 63. Diseases of the supra-renal glands ... ... | ... | 1 | 1 | 1 | ... | |
| 64. Diseases of the spleen ... ... ... ... | 1 | 39 | 4 | 40 | 2 | |
| 65. Leukæmia— | | | | | | |
| (*a*) Leukæmia ... ... ... ... ... | ... | 11 | 9 | 11 | ... | |
| (*b*) Hodgkin's disease ... ... ... ... | ... | 1 | ... | 1 | ... | |
| 66. Alcoholism ... ... ... ... ... ... | ... | 55 | ... | 55 | ... | |
| 67. Chronic poisoning by mineral substances (lead, mercury, etc.) ... ... ... ... | 1 | 38 | 4 | 39 | 7 | |
| 68. Chronic poisoning by organic substances (morphia, cocaine, etc.) ... ... ... | 1 | 55 | 2 | 56 | 4 | |
| 69. Other general diseases— | | | | | | |
| Auto-intoxication ... ... ... ... ... | ... | 4 | 2 | 4 | ... | |
| Purpura hæmorrhagica ... ... ... ... | ... | 2 | ... | 2 | ... | |
| Hæmophilia ... ... ... ... ... ... | ... | 2 | 1 | 2 | ... | |
| Diabetes insipidus ... ... ... ... ... | 2 | 8 | 2 | 10 | ... | |
| Other diseases ... ... ... ... ... | 7 | 100 | 9 | 107 | 3 | |
| **III.—AFFECTIONS OF THE NERVOUS SYSTEM AND ORGANS OF THE SENSES.** | | | | | | |
| 70. Encephalitis (not including encephalitis lethargica) ... ... ... ... ... | ... | 5 | 4 | 5 | ... | |
| 71. Meningitis (not including tuberculous meningitis or cerebro-spinal meningitis)... | 1 | 37 | 34 | 38 | ... | |
| 72. Locomotor ataxia ... ... ... ... ... | 7 | 5 | ... | 12 | 3 | |
| 73. Other affections of the spinal cord ... ... | 7 | 43 | 7 | 50 | 4 | |
| 74. Apoplexy— | | | | | | |
| (*a*) Hæmorrhage ... ... ... ... ... | 2 | 53 | 40 | 55 | 1 | |
| (*b*) Embolism ... ... ... ... ... | ... | 1 | 1 | 1 | ... | |
| (*c*) Thrombosis ... ... ... ... ... | ... | 3 | ... | 3 | ... | |
| 75. Paralysis— | | | | | | |
| (*a*) Hemiplegia ... ... ... ... ... | 34 | 129 | 38 | 163 | 36 | |
| (*b*) Other paralyses ... ... ... ... | 21 | 103 | 14 | 124 | 18 | |
| 76. General paralysis of the insane ... ... | ... | 1 | ... | 1 | ... | |
| 77. Other forms of mental alienation ... ... | 3 | 826 | ... | 829 | 7 | The majority of these were transferred to the Central Mental Hospital. |
| 78. Epilepsy ... ... ... ... ... ... ... | 2 | 113 | 12 | 115 | 3 | |
| 79. Eclampsia, convulsions (non-puerperal) 5 years or over ... ... ... ... ... ... | 1 | 20 | 8 | 21 | 1 | |

Table III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. |  | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
|  |  | Admissions. | Deaths. |  |  |  |
| III.—Affections of the Nervous System and Organs of the Senses—(*cont.*) |  |  |  |  |  |  |
| 80. Infantile convulsions | 1 | 80 | 44 | 81 | 1 |  |
| 81. Chorea | ... | 1 | ... | 1 | 1 |  |
| 82. A.—Hysteria | ... | 16 | ... | 16 | 1 |  |
| B.—Neuritis | 16 | 290 | 2 | 306 | 10 |  |
| C.—Neurasthenia | ... | 58 | ... | 58 | ... |  |
| D.—Neuralgia | ... | 21 | ... | 21 | 2 |  |
| 83. Cerebral softening | 1 | 10 | 5 | 11 | ... |  |
| 84. Other affections of the nervous system, such as paralysis agitans | 4 | 184 | 8 | 188 | 2 |  |
| 85. Affections of the organs of vision— |  |  |  |  |  |  |
| (*a*) Diseases of the eye | ... | 23 | ... | 23 | 1 |  |
| (*b*) Conjunctivitis | 18 | 487 | ... | 505 | 14 |  |
| (*c*) Trachoma | 20 | 99 | 1 | 119 | 22 |  |
| (*d*) Tumours of the eye | ... | 11 | ... | 11 | 1 |  |
| (*e*) Other affections of the eye | 165 | 959 | 3 | 1,124 | 158 |  |
| 86. Affections of the ear or mastoid sinus | 12 | 308 | 2 | 320 | 12 |  |
| IV.—Affections of the Circulatory System. |  |  |  |  |  |  |
| 87. Pericarditis | ... | 31 | 25 | 31 | 2 |  |
| 88. Acute endocarditis or myocarditis | 2 | 20 | 11 | 22 | 1 |  |
| 89. Angina pectoris | ... | 6 | 1 | 6 | ... |  |
| 90. Other diseases of the heart— |  |  |  |  |  |  |
| (*a*) Valvular— |  |  |  |  |  |  |
| Mitral | 10 | 275 | 110 | 285 | 17 |  |
| Aortic | 9 | 62 | 35 | 71 | 3 |  |
| Tricuspid | ... | 2 | 2 | 2 | ... |  |
| Pulmonary | ... | ... | ... | ... | ... |  |
| Undefined | 6 | 45 | 20 | 51 | 4 |  |
| (*b*) Myocarditis | 5 | 157 | 86 | 162 | 11 |  |
| (*c*) Functional | ... | 4 | 2 | 4 | ... |  |
| (*d*) Other diseases | ... | 62 | 29 | 62 | 5 |  |
| 91. Diseases of the arteries— |  |  |  |  |  |  |
| (*a*) Aneurism | 1 | 28 | 13 | 29 | 2 |  |
| (*b*) Arterio-sclerosis | 2 | 16 | 4 | 18 | 3 |  |
| (*c*) Other diseases | 1 | 16 | 9 | 17 | ... |  |
| 92. Embolism or thrombosis (non-cerebral) | 1 | 6 | 4 | 7 | ... |  |
| 93. Diseases of the veins— |  |  |  |  |  |  |
| Hæmorrhoids | 6 | 225 | 1 | 231 | 10 |  |
| Varicose veins | 1 | 24 | ... | 25 | 6 |  |
| Phlebitis | 1 | 6 | 1 | 7 | ... |  |
| 94. Diseases of the lymphatic system— |  |  |  |  |  |  |
| Lymphangitis | ... | 43 | ... | 43 | 4 |  |
| Lymphadenitis, bubo (non-specific) | 33 | 436 | 3 | 469 | 17 |  |
| 95. Hæmorrhage of undetermined cause | ... | 6 | 1 | 6 | 1 |  |
| 96. Other affections of the circulatory system | 1 | 43 | 12 | 44 | 1 |  |
| V.—Affections of the Respiratory System. |  |  |  |  |  |  |
| 97. Diseases of the nasal passages— |  |  |  |  |  |  |
| Adenoids | ... | 22 | ... | 22 | 1 |  |
| Polypus | ... | 21 | ... | 21 | ... |  |
| Rhinitis | ... | 38 | ... | 38 | ... |  |
| Coryza | 1 | 313 | ... | 314 | 3 |  |
| Other diseases | 1 | 42 | 2 | 43 | ... |  |

## Table III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. |  | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
|  |  | Admissions. | Deaths. |  |  |  |
| V.—Affections of the Respiratory System—(*cont.*) |  |  |  |  |  |  |
| 98. Affections of the larynx— |  |  |  |  |  |  |
| Laryngitis ... ... ... ... ... | ... | 42 | 6 | 42 | 1 |  |
| 99. Bronchitis— |  |  |  |  |  |  |
| (*a*) Acute ... ... ... ... ... | 44 | 2,414 | 28 | 2,458 | 70 |  |
| (*b*) Chronic ... ... ... ... ... | 65 | 1,131 | 62 | 1,196 | 59 |  |
| 100. Broncho-pneumonia ... ... ... ... | 31 | 908 | 398 | 939 | 27 |  |
| 101. Pneumonia— |  |  |  |  |  |  |
| (*a*) Lobar ... ... ... ... ... | 86 | 2,211 | 1,034 | 2,297 | 95 |  |
| (*b*) Unclassified ... ... ... ... | 4 | 106 | 38 | 110 | 4 |  |
| 102. Pleurisy, empyema ... ... ... ... | 26 | 349 | 46 | 375 | 22 |  |
| 103. Congestion of the lungs ... ... ... | 1 | 4 | ... | 5 | ... |  |
| 104. Gangrene of the lungs ... ... ... ... | 1 | 27 | 21 | 28 | ... |  |
| 105. Asthma ... ... ... ... ... ... | 34 | 778 | 15 | 812 | 24 |  |
| 106. Pulmonary emphysema ... ... ... | ... | 4 | 1 | 4 | ... |  |
| 107. Other affections of the lungs— |  |  |  |  |  |  |
| Pulmonary spirochaetosis ... ... ... | ... | ... | ... | ... | ... |  |
| Other diseases ... ... ... ... | ... | 79 | 35 | 79 | 5 |  |
| VI.—Diseases of the Digestive System. |  |  |  |  |  |  |
| 108. A.—Diseases of teeth or gums— |  |  |  |  |  |  |
| Caries, pyorrhœa, etc. ... ... ... | 5 | 332 | 4 | 337 | 6 |  |
| B.—Other affections of the mouth— |  |  |  |  |  |  |
| Stomatitis ... ... ... ... ... ... | 1 | 119 | 6 | 120 | 6 |  |
| Glossitis, etc. ... ... ... ... ... ... | 1 | 18 | ... | 19 | ... |  |
| 109. Affections of the pharynx or tonsils— |  |  |  |  |  |  |
| Tonsillitis ... ... ... ... ... ... | 2 | 226 | ... | 228 | 2 |  |
| Pharyngitis ... ... ... ... ... ... | 1 | 222 | 2 | 223 | 3 |  |
| Other diseases ... ... ... ... ... | ... | 10 | 2 | 10 | 3 |  |
| 110. Affections of the œsophagus ... ... ... | 1 | 12 | 1 | 13 | 2 |  |
| 111. A.—Ulcer of the stomach ... ... ... | 3 | 94 | 23 | 97 | 3 |  |
| B.—Ulcer of the duodenum ... ... ... | 2 | 60 | 9 | 62 | 7 |  |
| 112. Other affections of the stomach— |  |  |  |  |  |  |
| Gastritis ... ... ... ... ... ... | 6 | 449 | 11 | 455 | 10 |  |
| Dyspepsia, etc. ... ... ... ... ... | 5 | 479 | 1 | 484 | 14 |  |
| 113. Diarrhœa and enteritis— |  |  |  |  |  |  |
| Under two years ... ... ... ... ... | 15 | 480 | 142 | 495 | 8 |  |
| 114. Diarrhœa and enteritis— |  |  |  |  |  |  |
| Two years and over ... ... ... ... ... | 62 | 1,588 | 193 | 1,650 | 49 |  |
| Colitis ... ... ... ... ... ... ... | 1 | 179 | 11 | 180 | 1 |  |
| Ulceration ... ... ... ... ... ... | ... | 1 | 1 | 1 | ... |  |
| 114A. Sprue ... ... ... ... ... ... ... | 5 | 84 | 17 | 89 | 6 |  |
| 115. Ankylostomiasis ... ... ... ... ... | 83 | 1,636 | 65 | 1,719 | 54 |  |
| 116. Diseases due to intestinal parasites— |  |  |  |  |  |  |
| (*a*) Cestoda (tænia) ... ... ... ... | ... | 4 | ... | 4 | 1 |  |
| (*b*) Trematoda (flukes) ... ... ... ... | ... | 1 | ... | 1 | ... |  |
| (*c*) Nematoda (other than ankylostoma)— |  |  |  |  |  |  |
| Ascaris ... ... ... ... ... | 58 | 2,391 | 23 | 2,449 | 38 |  |
| Trichocephalus dispar ... ... ... | ... | 1 | ... | 1 | ... |  |
| Trichina ... ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| Dracunculus ... ... ... ... ... | ... | 15 | ... | 15 | ... |  |
| Strongylus ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| Oxyuris ... ... ... ... ... ... | ... | 1 | ... | 1 | ... |  |
| (*d*) Coccidia ... ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| (*e*) Other parasites ... ... ... ... ... | ... | 9 | ... | 9 | ... |  |
| (*f*) Unclassified ... ... ... ... ... | ... | ... | ... | ... | ... |  |

TABLE III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. |  | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
|  |  | Admissions. | Deaths. |  |  |  |
| VI.—DISEASES OF THE DIGESTIVE SYSTEM—(*cont.*) |  |  |  |  |  |  |
| 117. Appendicitis ... ... ... ... ... | 7 | 245 | 19 | 252 | 17 |  |
| 118. Hernia ... ... ... ... ... ... | 12 | 228 | 13 | 240 | 9 |  |
| 119. A.—Affections of the anus, fistula, etc. ... | 6 | 206 | 8 | 212 | 4 |  |
| B.—Other affections of the intestines— |  |  |  |  |  |  |
| Enteroptosis ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| Constipation ... ... ... ... ... | 7 | 755 | 3 | 762 | 11 |  |
| Other diseases ... ... ... ... | 4 | 232 | 20 | 236 | 2 |  |
| 120. Acute yellow atrophy of the liver ... ... | ... | 1 | 1 | 1 | ... |  |
| 121. Hydatid of the liver ... ... ... ... | ... | ... | ... | ... | ... |  |
| 122. Cirrhosis of the liver— |  |  |  |  |  |  |
| (*a*) Alcoholic ... ... ... ... | ... | 34 | 22 | 34 | 2 |  |
| (*b*) Other forms ... ... ... ... | 24 | 354 | 169 | 378 | 37 |  |
| 123. Biliary Calculus ... ... ... ... | ... | 15 | 2 | 15 | ... |  |
| 124. Other affections of the liver— |  |  |  |  |  |  |
| Abscess ... ... ... ... ... | 3 | 89 | 24 | 92 | 10 |  |
| Hepatitis ... ... ... ... ... | 7 | 156 | 3 | 163 | 4 |  |
| Cholecystitis ... ... ... ... ... | 2 | 50 | 13 | 52 | 3 |  |
| Jaundice ... ... ... ... ... | 6 | 149 | 16 | 155 | 4 |  |
| Other diseases ... ... ... ... | 3 | 7 | 3 | 10 | ... |  |
| 125. Diseases of the pancreas ... ... ... | ... | 4 | 3 | 4 | ... |  |
| 126. Peritonitis (of unknown cause) ... ... | 1 | 74 | 66 | 75 | 2 |  |
| 127. Other affections of the digestive system ... | 5 | 170 | 29 | 175 | 6 |  |
| VII.—DISEASES OF THE GENITO-URINARY SYSTEM (NON-VENEREAL). |  |  |  |  |  |  |
| 128. Acute nephritis... ... ... ... ... | 32 | 468 | 132 | 500 | 32 |  |
| 129. Chronic ... ... ... ... ... ... | 30 | 273 | 128 | 303 | 28 |  |
| 130. A.—Chyluria ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| B.—Schistosomiasis ... ... ... ... | ... | ... | ... | ... | ... |  |
| 131. Other affections of the kidneys— Pyelitis, etc. ... ... ... ... ... | 6 | 175 | 25 | 181 | 5 |  |
| 132. Urinary calculus ... ... ... ... | 4 | 38 | 4 | 42 | 5 |  |
| 133. Diseases of the bladder— Cystitis ... ... ... ... ... | 1 | 101 | 7 | 102 | 2 |  |
| 134. Diseases of the urethra— |  |  |  |  |  |  |
| (*a*) Stricture ... ... ... ... ... | 5 | 103 | ... | 108 | 3 |  |
| (*b*) Other ... ... ... ... ... | 17 | 369 | 3 | 386 | 16 |  |
| 135. Diseases of the prostate— |  |  |  |  |  |  |
| Hypertrophy ... ... ... ... ... | ... | ... | ... | ... | ... |  |
| Prostatitis ... ... ... ... ... | 2 | 27 | ... | 29 | 2 |  |
| 136. Diseases (non-venereal) of the genital organs of man— |  |  |  |  |  |  |
| Epididymitis ... ... ... ... ... | 2 | 73 | ... | 75 | 1 |  |
| Orchitis ... ... ... ... ... | 2 | 78 | ... | 80 | ... |  |
| Hydrocele ... ... ... ... ... | 10 | 103 | 1 | 113 | 2 |  |
| Ulcer of penis ... ... ... ... | ... | 19 | ... | 19 | ... |  |
| Other diseases ... ... ... ... | 3 | 139 | 3 | 142 | 3 |  |
| 137. Cysts or other non-malignant tumours of the ovaries ... ... ... ... ... | 2 | 31 | 3 | 33 | 1 |  |
| 138. Salpingitis ... ... ... ... ... | 1 | 45 | 2 | 46 | 2 |  |
| Abscess of the pelvis... ... ... ... | 1 | 6 | 2 | 7 | ... |  |
| 139. Uterine tumours (non-malignant) ... ... | ... | 21 | 1 | 21 | ... |  |
| 140. Uterine hæmorrhage (non-puerperal) ... | 1 | 17 | ... | 18 | 1 |  |

## TABLE III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| VII.—DISEASES OF THE GENITO-URINARY SYSTEM (NON-VENEREAL)—(*cont.*) | | | | | | |
| 141. A.—Metritis | 1 | 31 | 4 | 32 | 1 | |
| B.—Other affections of the female genital organs— | | | | | | |
| Displacements of uterus | 5 | 69 | ... | 74 | 2 | |
| Amenorrhœa | ... | 14 | ... | 14 | ... | |
| Dysmenorrhœa | ... | 57 | ... | 57 | ... | |
| Leucorrhœa | ... | 117 | ... | 117 | 1 | |
| Other diseases | 5 | 176 | 1 | 181 | 9 | |
| 142. Diseases of the breast (non-puerperal)— | | | | | | |
| Mastitis | ... | 27 | ... | 27 | 1 | |
| Abscess of breast | 2 | 32 | ... | 34 | 1 | |
| Other diseases | ... | 3 | ... | 3 | 1 | |
| VIII.—PUERPERAL STATE. | | | | | | |
| 143. A.—Normal labour | 112 | 3,558 | 5 | 3,670 | 166 | |
| B.—Accidents of pregnancy— | | | | | | |
| (*a*) Abortion | 5 | 269 | 9 | 274 | 8 | |
| (*b*) Ectopic gestation | ... | 12 | 1 | 12 | 2 | |
| (*c*) Other accidents of pregnancy | 27 | 781 | 31 | 808 | 44 | |
| C.—Difficult labour | ... | 16 | ... | 16 | ... | |
| 144. Puerperal hæmorrhage | ... | 13 | 9 | 13 | ... | |
| 145. Other accidents of parturition | 3 | 195 | 34 | 198 | 6 | |
| 146. Puerperal septicæmia | 5 | 160 | 79 | 165 | 6 | |
| 147. Phlegmasia dolens | ... | 4 | ... | 4 | ... | |
| 148. Puerperal eclampsia | 1 | 42 | 16 | 43 | 1 | |
| 149. Sequelæ of labour | 1 | 56 | 3 | 57 | ... | |
| 150. Puerperal affections of the breast | ... | 1 | ... | 1 | ... | |
| IX.—AFFECTIONS OF THE SKIN AND CELLULAR TISSUES. | | | | | | |
| 151. Gangrene | 4 | 63 | 35 | 67 | 1 | |
| 152. Boil | 1 | 108 | ... | 109 | 1 | |
| Carbuncle | 7 | 72 | 8 | 79 | 3 | |
| 153. Abscess | 97 | 2,156 | 23 | 2,253 | 89 | |
| Whitlow | 1 | 26 | ... | 27 | 2 | |
| Cellulitis | 43 | 664 | 81 | 707 | 52 | |
| 154. A.—Tinea | ... | 106 | ... | 106 | 4 | |
| B.—Scabies | 48 | 853 | ... | 901 | 16 | |
| 155. Other diseases of the skin— | | | | | | |
| Erythema | 1 | 13 | ... | 14 | ... | |
| Urticaria | 1 | 60 | ... | 61 | ... | |
| Eczema | 19 | 547 | ... | 566 | 18 | |
| Herpes | 2 | 63 | ... | 65 | 2 | |
| Psoriasis | 3 | 11 | ... | 14 | ... | |
| Elephantiasis | ... | 13 | ... | 13 | 2 | |
| Myiasis | ... | 1 | ... | 1 | ... | |
| Chigœs | ... | ... | ... | ... | ... | |
| Cutaneous leishmaniasis | ... | ... | ... | ... | ... | |
| Other diseases | 9 | 119 | 6 | 128 | 8 | |
| 155A. Chronic ulcers | 223 | 3,521 | 57 | 3,744 | 197 | |

TABLE III—(*cont.*)

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| **X.—DISEASES OF BONES AND ORGANS OF LOCOMOTION (OTHER THAN TUBERCULOUS).** | | | | | | |
| 156. Diseases of bones— | | | | | | |
| Osteitis | 8 | 63 | 4 | 71 | 3 | |
| 157. Diseases of joints— | | | | | | |
| Arthritis | 30 | 308 | 4 | 338 | 27 | |
| Synovitis | 9 | 102 | ... | 111 | 5 | |
| 158. Other diseases of bones or organs of locomotion | 14 | 369 | 10 | 383 | 26 | |
| **XI.—MALFORMATIONS.** | | | | | | |
| 159. Malformations— | | | | | | |
| Hydrocephalus | ... | 6 | 1 | 6 | ... | |
| Hypospadias | ... | 2 | ... | 2 | ... | |
| Spina bifida, etc. | ... | 3 | ... | 3 | ... | |
| Other malformations | ... | 23 | 1 | 23 | 3 | |
| **XII.—DISEASES OF INFANCY.** | | | | | | |
| 160. Congenital debility | 2 | 70 | 52 | 72 | 2 | |
| 161. Premature birth | 1 | 310 | 226 | 311 | 3 | |
| 162. Other affections of infancy | 5 | 152 | 73 | 157 | 7 | |
| 163. Infant neglect (infants of three months or over) | 4 | 14 | 7 | 18 | ... | |
| **XIII.—AFFECTIONS OF OLD AGE** | | | | | | |
| 164. Senility— | | | | | | |
| Senile dementia | ... | ... | ... | ... | ... | |
| Senile debility | 67 | 598 | 137 | 665 | 138 | |
| **XIV.—AFFECTIONS PRODUCED BY EXTERNAL CAUSES.** | | | | | | |
| 165. Suicide by poisoning | ... | 2 | 2 | 2 | ... | |
| 166. Corrosive poisoning (intentional) | ... | 11 | 1 | 11 | ... | |
| 167. Suicide by gas poisoning | ... | ... | ... | ... | ... | |
| 168. Suicide by hanging or strangulation | ... | 4 | 4 | 4 | ... | |
| 169. Suicide by drowning | ... | 2 | 2 | 2 | ... | |
| 170. Suicide by firearms | ... | 1 | 1 | 1 | ... | |
| 171. Suicide by cutting or stabbing instruments | ... | 6 | 3 | 6 | ... | |
| 172. Suicide by jumping from a height | ... | ... | ... | ... | ... | |
| 173. Suicide by crushing | ... | ... | ... | ... | ... | |
| 174. Other suicides | ... | 1 | ... | 1 | ... | |
| 175. Food poisoning | ... | 33 | ... | 33 | ... | |
| Botulism | ... | 1 | ... | 1 | 1 | |
| 176. Attacks of poisonous animals— | | | | | | |
| Snake bite | 3 | 25 | 1 | 28 | 3 | |
| Insect bite | 1 | 48 | 1 | 49 | ... | |
| Others | ... | 13 | 1 | 13 | 1 | |
| 177. Other accidental poisonings | ... | 78 | 5 | 78 | 3 | |
| 178. Burns (by fire) | 8 | 177 | 17 | 185 | 8 | |
| 179. Burns (other than by fire) | 5 | 260 | 11 | 265 | 13 | |
| 180. Suffocation (accidental) | ... | ... | ... | ... | ... | |

TABLE III—(*cont.*)

## RETURN OF DISEASES AND DEATHS (IN-PATIENTS) IN GOVERNMENT HOSPITALS—(*cont.*)

| Diseases. | Remaining in hospital at the end of 1928. | Yearly total. | | Total cases treated. | Remaining in hospital at the end of 1929. | Remarks. |
|---|---|---|---|---|---|---|
| | | Admissions. | Deaths. | | | |
| XIV.—AFFECTIONS PRODUCED BY EXTERNAL CAUSES—(*cont.*) | | | | | | |
| 181. Poisoning by gas (accidental) ... ... | ... | ... | .. | ... | ... | |
| 182. Drowning (accidental)... ... ... ... | ... | ... | ... | ... | ... | |
| 183. Wounds (by firearms, war excepted) ... | 6 | 27 | 3 | 33 | 2 | |
| 184. Wounds (by cutting or stabbing instruments) | 87 | 2,400 | 45 | 2,487 | 97 | |
| 185. Wounds (by fall) ... ... ... ... | 50 | 2,290 | 7 | 2,340 | 52 | |
| 186. Wounds (in mines or quarries) ... ... | 17 | 414 | 5 | 431 | 14 | |
| 187. Wounds (by machinery) ... ... ... | 8 | 206 | 3 | 214 | 8 | |
| 188. Wounds (crushing, e.g., railway accidents, etc.) | 5 | 184 | 3 | 189 | 9 | |
| 189. Injuries inflicted by animals, bites, kicks, etc. | 14 | 116 | 3 | 130 | 8 | |
| 190. Wounds inflicted on active service ... ... | ... | ... | ... | ... | ... | |
| 191. Executions of civilians by belligerents ... | ... | ... | ... | ... | ... | |
| 192. A.—Over fatigue ... ... ... ... | ... | 1 | ... | 1 | ... | |
| B.—Hunger or thirst ... ... ... ... | ... | ... | ... | ... | ... | |
| 193. Exposure to cold, frost bite, etc. ... ... | ... | 2 | 1 | 2 | ... | |
| 194. Exposure to heat— | | | | | | |
| Heatstroke ... ... ... ... ... ... | ... | 2 | ... | 2 | ... | |
| Sunstroke ... ... ... ... ... ... | ... | ... | ... | ... | ... | |
| 195. Lightning stroke ... ... ... ... | ... | 2 | ... | 2 | ... | |
| 196. Electric shock ... ... ... ... ... | ... | 3 | ... | 3 | ... | |
| 197. Murder by firearms ... ... ... ... | ... | 1 | 1 | 1 | ... | |
| 198. Murder by cutting or stabbing instruments | ... | ... | ... | ... | ... | |
| 199. Murder by other means ... ... ... | ... | ... | ... | ... | ... | |
| 200. Infanticide (murder of an infant under one year) ... ... ... ... ... | ... | ... | ... | ... | ... | |
| 201. A.—Dislocation ... ... ... ... ... | 4 | 80 | ... | 84 | 1 | |
| B.—Sprain ... ... ... ... ... ... | 3 | 277 | 1 | 280 | 4 | |
| C.—Fracture ... ... ... ... ... ... | 107 | 1,217 | 143 | 1,324 | 127 | |
| 202. Other external injuries ... ... ... | 49 | 1,828 | 13 | 1,877 | 66 | |
| 203. Deaths by violence of unknown cause ... | ... | ... | ... | ... | ... | |
| XV.—ILL-DEFINED DISEASES. | | | | | | |
| 204. Sudden death (cause unknown) ... ... | ... | 1 | 1 | 1 | ... | |
| 205. A.—Diseases not already specified or ill-defined— | | | | | | |
| Ascites ... ... ... ... ... ... | 1 | 50 | 8 | 51 | 4 | |
| Œdema ... ... ... ... ... ... | ... | 11 | ... | 11 | 1 | |
| Asthenia ... ... ... ... ... ... | 4 | 118 | 15 | 122 | 4 | |
| Shock ... ... ... ... ... ... ... | ... | 32 | 21 | 32 | ... | |
| Hyperpyrexia... ... ... ... ... ... | ... | 7 | 1 | 7 | ... | |
| B.—Malingering ... ... ... ... ... | ... | 5 | ... | 5 | ... | |
| C.—Pyrexia of unknown origin ... ... | 25 | 649 | 34 | 674 | 11 | |
| D.—Diagnosis undetermined... ... ... | 239 | 2,549 | 3 | 2,788 | 161 | |
| XVI.—DISEASES, THE TOTAL OF WHICH HAVE NOT CAUSED 10 DEATHS. ... ... | ... | ... | ... | ... | ... | |
| Total ... | 4,644 | 113,647 | 9,756 | 118,298 | 4,775 | |
| Accompanying patients ... ... ... ... ... | 63 | 2,394 | ... | 2,457 | 51 | |

## APPENDIX I.

# ANNUAL REPORT OF THE INSTITUTE FOR MEDICAL RESEARCH FOR THE YEAR 1929.

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## I.—STAFF.

### DIRECTOR:

A. Neave Kingsbury, M.D., B.S., B.SC. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H., D.T.M. AND H. (Lond.).

### BACTERIOLOGICAL DIVISION.

*Bacteriologist:* G. V. Allen, M.D., B.CH., B.A.O. (Belf.), D.T.M. AND H. (Lond.).

*Assistant:* J. E. Lesslar, D.M.C. (Madras).

### PATHOLOGICAL DIVISION.

*Pathologist:* P. H. Martin, M.A., B.M., B.CH. (Oxon.), M.R.C.P. (Lond.), D.T.M. AND H. (Lond.).

*Assistant:* S. R. Savoor, M.B., B.S. (Madras).

### CHEMICAL DIVISION.

*Chief Chemist:* R. W. Blair, A.R.C.SC.I., F.I.C.

*Chemists:* J. Shelton, F.I.C. (seconded to T. & C. Dept.); F. E. Byron, Ph.D., B.SC. (Liv.), A.I.C.; I. A. Simpson, Ph.D., B.SC. (Liv.), A.I.C.

### ENTOMOLOGICAL DIVISION.

*Entomologist:* B. A. R. Gater, M.A. (Cantab.), D.I.C. (Lond.).

### MALARIA RESEARCH.

*Malaria Research Officers:* R. Green, M.D., B.S. (Melb.); C. Russell Amies, M.B., B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.T.M. AND H. (Lond.).

### TYPHUS RESEARCH.

L. Anigstein, M.D. (Poznan), Ph.D. (Heidlbg.).

### SEROLOGICAL SECTION.

K. Kanagarayer, L.M.S. (S'pore), D.T.M. (Bengal).

### IPOH BRANCH LABORATORY.

R. Lewthwaite, M.A., B.M., B.CH. (Oxon.) M.R.C.S. (Eng.), L.R.C.P. (Lond.).

### OFFICE.

*Chief Clerk:* R. Mailvaganam.

### LIBRARY.

*Librarian:* V. Nagalingam.

## II.—GENERAL.

During the period under review, the various buildings for the new lymph station have been completed; an old animal house in the Institute compound has been reconstructed as a stable, and a suitable operating room erected nearby. A grazing ground, some ten acres in area, and distant about a mile from the laboratories, has been made available. This has been subdivided for quarantine purposes, by double fencing, and stables constructed on each division. Lymph production was commenced in a small way in the later months of the year and it is anticipated that, by March next, stocks will be sufficient to meet local demands.

On August 21st a branch laboratory was opened in the Kinta Sanitary Board Buildings, Ipoh. Though accommodation is cramped, the situation is conveniently near the railway station—a point of importance as a large number of specimens are received by train from outlying hospitals. The laboratory, which was opened by Dr. K. Kanagarayer with two laboratory assistants, undertakes bacteriological, serological and pathological examinations for the Perak hospitals and practitioners. Up to the end of the year no less than 3,980 reports were furnished on various specimens.

The lack of a lecture theatre for scientific meetings in Kuala Lumpur has been felt for many years past : during the year it has been possible to recondition a large room in the original I.M.R. building, which had been previously utilised as an office. It has been suitably furnished and is now used for the meetings of local medical and chemical societies.

Routine work has pressed heavily on certain divisions during the year. The number of Wassermann reactions and other tests was increasing rapidly in the early months, and many of the specimens appeared to be non-essential for diagnosis. Action was accordingly taken to reduce unnecessary examinations to a minimum and, as a further measure of relief, prophylactic vaccination against rabies was completely decentralised to hospitals.

An unusual departure has been the recent appointment, as Research Student, of Dr. L. Anigstein from Warsaw to work on the local problem of tropical typhus. Apart from the intrinsic value of the researches, the occasional appointment of a worker from a foreign laboratory would appear to be definitely advantageous. In the present instance the introduction of new methods of technique has resulted, and the effect of the appointment has been a stimulating one.

## III.—RESEARCH.

### TROPICAL TYPHUS.

The investigations of tropical typhus which are summarised below have been undertaken by several of the Institute staff. Dr. L. Anigstein has supplied a résumé of his important researches on experimental animals, the bacteriological findings from human cases and experimental animals, experimental transmission by the body and head louse and the examination of rats caught on the oil-palm estate, from which comes so large a proportion of the cases. Dr. R. Lewthwaite contributed the sections on clinical signs, morbid anatomy and histopathology. His also are the epidemiological observations in regard to the Federated Malay States generally, and the oil-palm estate in particular. Mr. B. A. R. Gater has worked on the vector problem. He has examined early cases minutely for evidence of arthropod attack and also a large number of labourers, fresh from the field, where presumably they had been exposed to infection. He has also been responsible for the collection and examination of mites from oil-palms, the survey of the ectoparasites of rats, and the maintenance of lice for experimental purposes. Finally, the Weil-Felix reactions have been carried out in the Bacteriological Division by Dr. G. V. Allen and, later in the year, by Dr. P. H. Martin, while histological sections have been prepared by the Pathological Division under Dr. P. H. Martin and later under Dr. R. Lewthwaite.

About the middle of the year a review was undertaken of one hundred and sixty-four cases of tropical typhus. Of these, one hundred and twenty-one had occurred in the endemic on an oil-palm estate near Kuala Lumpur, referred to at length in previous reports. The remainder had occurred elsewhere in Malaya. The whole series comprised, with few exceptions, all the cases that had been recorded in this country between January, 1927, and April, 1929. Many interesting features became apparent, although they serve only to amplify the detailed descriptions already issued in previous publications. There appeared to be no differing clinical features on which a differential diagnosis between the two serologically differing forms of tropical typhus could be made. Only by agglutination tests with the respective "W" and "K" strains of *Proteus X 19* could the diagnosis be established.

In two diseases very akin to tropical typhus an initial lesion is found; in the tsutsugamushi disease, the primary ulcer with attendant bubo; in the "fièvre boutonneuse" of Marseilles and Tunis the "tache noire". Despite careful search, none was found in any of the present series of cases of tropical typhus.

With regard to the febrile reaction, a feature noted by Wolbach and others in European typhus was evident also in tropical typhus, namely, the slight degree of fever in some of the delirious or stuporous patients. In two such cases that ended fatally the average temperature during the last four and five days, respectively, was in the region of 99.6°F.

An eye-sign of great value in diagnosis was present in 40 per cent. of the cases. It consists of a characteristic mild suffusion. The eyes are half-closed, somewhat watery, and faintly glistening, giving a dull yet anxious appearance to the countenance. Injection of the vessels is usually not marked, much less so than in cases of leptospirosis, mild cases of which may offer difficulty in early diagnosis. In the darker-skinned of the Asiatics a rash may be either not seen at all, or be very indefinite in character; and in such cases this eye-sign is a valuable aid in early diagnosis, at a time when other symptoms and signs such as cough, chest pain, deafness, headache, and enlargement of lymphatic glands of groin and axilla may be but slight.

Complications were noted in many cases. Of these, by far the commonest was an acute bronchitis or broncho-pneumonia, supervening early in the second week, though in one case after deferevescence. Other complications were rare. In two cases there was thrombosis of the veins of the leg. One patient developed a bilateral parotitis, and, with it, a unilateral facial paralysis. In another a subdural haemorrhage on the thirteenth day of illness was the immediate cause of death.

In so far as figures of percentage mortality can be deduced from the cases occurring during the past three years, it would seem from the following figures that the virulence of this disease is increasing.

DEATH-RATES FOR ENDEMIC CASES FROM THE OIL-PALM ESTATE.

| | 1927. | 1928. | 1929. |
|---|---|---|---|
| Number of cases | 46 | 46 | 68 |
| Number of deaths | 2 | 5 | 10 |
| Percentage of fatal cases | 4 | 10 | 14.7 |

## Post-mortem Findings.

In seven fatal cases of the "K" type of tropical typhus post-mortem examinations were obtained. A detailed description of the findings is in course of preparation; they are given below in outline only.

## Morbid Anatomy.

Naked-eye examination gave no one consistent feature that could be regarded as peculiar to tropical typhus; but gave rather an aggregation of a few pathological changes, more often than not only slight in degree, such as are frequently to be observed individually, or some of them collectively, in the morbid anatomy of other diseases.

Lungs: In all seven cases there was bi-lateral congestion and oedema of the lungs. Slight in one case, it was marked in six cases. In two, broncho-pneumonia was present. Small punctiform sub-pleural haemorrhages were present in all cases.

Trachea: The mucous membrane was covered with blood-stained mucus in four cases.

Spleen: This was small (3½ ozs.) in one case; in all others it was enlarged, the respective weights being 11½ ozs., 17 ozs., 19 ozs., 22 ozs., 22 ozs., and 31 ozs. All these victims were of the sparse build of the Tamil labourer; on the other hand it is probable that most of them had suffered from one or several attacks of malaria either in India or Malaya. In four cases the spleen was diffluent, as in an acute septic spleen. Subcapsular haemorrhages were present in one instance.

Lymphatic glands: Enlargement of these was insignificant in three cases, was considerable in two cases, and marked in two cases. The glands along the course of the iliac arteries, the paravertebral glands in the lumbar region, and the mediastinal glands were mostly affected.

Liver: There was some enlargement in four of the cases, the appearance of fatty change in three, and punctiform haemorrhages visible on the surface in two.

Kidney: In one instance minute haemorrhages were present on the surface, in the kidney substance, and on the surface of the pelvis of the kidney. Otherwise, apart from occasional slight cloudy swelling and congestion, there was nothing noteworthy.

Testis: In one case there was injection; in others, nothing abnormal.

Intestinal Tract: There was no enlargement of the Peyer's patches or lymphoid follicles, nor any other morbid change.

Heart: Minute haemorrhages were visible beneath the epicardium in one instance, and on the musculi papillares in another. No other abnormal feature was found.

Brain: Injection of the vessels of the surface was noted in five cases, a glazed appearance of the surface in two, and a marked increase in cerebro-spinal fluid in two,

## Histo-pathology.

The examination of the histological changes in the above material is still in progress at the time of writing, and will be described fully in a forthcoming publication. But the findings in sections of the cerebral cortex may here be summarised. They were:

(1) A slight but definite perivascular infiltration of the smaller pre-capillaries of the brain with mononuclear cells.

(2) The presence within the wall of these pre-capillaries of minute diplococcal forms, lying usually within swollen endothelial cells but occasionally extra-cellularly. In many instances they were arranged in clumps. Stained by Giemsa they were dark-blue in colour, although exceptionally the colour had a purplish tinge. Thus the picture corresponded closely with that described and illustrated by Wolbach, Todd and Palfrey in their monograph, "The Aetiology and Pathology of Typhus," 1922, and by Stevenson and Balfour (*Jour. of Path. and Bact.* Vol. 24, 1921).

(3) The occurrence of somewhat coarse greenish-blue pigment in the walls of these vessels.

(4) The presence within the large pyramidal cells of the cerebral cortex, of diplococcal forms, similar to those found in the walls of the infiltrated vessels.

(5) A general increase of cellular elements in the cortex, probably mostly neuroglial cells, together with a few leucocytes.

(6) A few focal areas of infiltration.

## Experimental Tropical Typhus in Laboratory Animals.

Investigation of the reproduction of tropical typhus in laboratory animals has been continued; guinea-pigs, rats and rabbits have been inoculated with virus from 17 human cases in the early stages of the disease. Blood, taken from patients at the end of the first week of illness, produced only slight fever in guinea-pigs after 20 days and for a period of 5 to 9 days. In a proportion of rats, similarly inoculated, a rise of temperature occurred for 5 days after an incubation of 6 days. Passages, made with brain of rats and guinea-pigs killed during the fever, did not produce a febrile reaction in the next generation of guinea-pigs, but the animals died within three weeks. An absence of fever was again observed in the third passage of guinea-pigs but the majority of rats showed an irregular febrile reaction after 8 days. Despite absence of fever in the passage guinea-pigs, infection was demonstrated by a rise of agglutinins for *Proteus X 19* ("K" strain) from 0 to 1/25 in a rabbit, inoculated intra-peritoneally with brain of a third passage guinea-pig.

For the next series of inoculations with patient's blood only rats were utilised, with the result that, of 26 rats, 4 reacted with continuous fever for 6 to 8 days after 9 to 11 days' incubation. The remaining rats showed an irregular temperature often without any period of incubation. Fever was reproduced in a second passage, specific infection being indicated by the Weil-Felix reaction which, in some instances, was positive in dilutions of 1/125 to 1/250 of the rats' sera. These experiments have confirmed the susceptibility of the local rat to tropical typhus but have also shown that a febrile reaction is not a constant symptom.

Further observations on guinea-pigs inoculated with human virus (blood or brain), have shown that, in a proportion of animals, a marked decline of body-weight occurs, although temperature may remain normal. Some of such guinea-pigs died without any sign of a secondary infection. Autopsies showed normal spleens in all the fatal cases and congested lungs with haemorrhagic infarcts, such as are often found in experimental typhus exanthematicus. The great majority of infected male guinea-pigs presented lesions of the testicles in the form of a haemorrhagic gelatinous exudate and a marked injection of the tunica vaginalis. Microscopic examination of smears, made from the exudate, revealed very similar pictures to those observed in Mexican and European typhus. In certain cases a large number of pleomorphic micro-organisms was noticed in the form of slender spindle-shaped bacilli, or diplo-bacilli, and minute cocci, situated extra or intra-cellularly in the cytoplasm of large lymphocytes and monocytes. The organisms were found in the great majority of guinea-pigs in which infection was indicated clinically by loss of weight, and pathologically by inflammatory reaction in the testicles.

The histological examination of the brain of guinea-pigs infected with tropical typhus, and killed after marked loss of body-weight, showed lesions identical with those regarded as characteristic for typhus, namely, perivascular infiltration and collections of mononuclear cells in the form of nodules.

## The Weil-Felix Reaction in Rats and Rabbits.

The Weil-Felix reaction has been carried out on the sera of 64 rats inoculated with tropical typhus virus. Four strains of *Proteus X 19*—"K", "W", "H" and "O"—were used, cultures being killed by heat or alcohol and reading made according to Dreyer's method. The first group of sera was from 22 rats inoculated intra-peritoneally with blood from ten different typhus patients and with brain from two cases. A definite reaction in a dilution of 1/50 may be regarded as the lowest limit of a positive result in rats. The original human cases were all of the "K" serological type and agglutination of the "K" strain occurred in dilutions of the rat's sera of 1/125 and 1/250 after 16 to 22 days of incubation. The "O" strain was agglutinated only in one instance to a titre of 1/250. Analogous results were obtained from rats inoculated with brains of 17 guinea-pigs infected with human virus of tropical typhus. Rabbits inoculated with tropical typhus also showed a rise of agglutinins (up to 1/50 and 1/125), in some cases for all strains of *Proteus X 19*, in others, for certain strains only.

## Bacteriological Findings.

Attempts have been made to cultivate the germ of tropical typhus by employing methods which have proved successful in previous work on European typhus. Blood was taken as early as possible, defibrinated by shaking with glass beads, and quantities of about 3 c.cms. were inoculated into the culture tubes. The medium consisted of Hottinger broth, containing 0.5 per cent. glucose and adjusted to a pH between 7.0 to 7.2. To 6 c.cms. of broth 2 c.cms. of ascitic fluid were added and the tubes were kept at 37°C. for at least 72 hours and afterwards at room temperature (26 to 30°C.) for five days. During the period a greyish layer of sedimented blood, consisting of white corpuscles, blood platelets and, in positive cultures, of micro-organisms is formed. During growth the liquid medium may remain transparent, or become opaque, or turbid after long incubation. When turbidity is present it is usually due to minute coccal forms, while the greyish deposit may contain bacillary forms of fusiform or "diphtheroid" type. After a week's incubation the first subculture was made on blood-ascitic-agar, the latter medium being prepared by mixing nine parts of hot "Harrison" agar (at about 80°C.) with one part of defibrinated horse blood. After cooling, 15 per cent. of ascitic fluid was added to the mixture. The medium was sloped in tubes provided with rubber caps. About 0.5 c.cm. of the blood from the primary culture was sub-inoculated in several of these tubes. Growth usually appears after 48 hours incubation at 37°C. as dew drop-like colonies or as a greyish, sometimes yellowish, and mostly mucoid, film. The greyish film usually showed Gram negative slender bacilli while the dew drop-like colonies gave minute coccal forms. In instances when no growth was visible after the first sub-inoculation, a second and third subculture from the water of condensation were attempted. When abundant growth had occurred on this "chocolate" agar, strains were cultivated on ascitic-Harrison agar without addition of blood.

The bacteriological findings from 30 patients with tropical typhus are discussed below. The microscopic appearance of the cultures was characterised by highly developed pleomorphism, this also being a marked feature of cultures from European typhus. The ten strains, which have been isolated from tropical typhus, formed three morphological groups, namely, slender bacilli of fusiform type, the granular *Rickettsia* type and the "diphtheroid" type. All cultures were Gram negative. Owing to the pleomorphism, one morphological type, for instance the fusiform bacilli, sometimes appeared in the form of minute cocci or diploccocci, which on further subcultures were occasionally transformed into rods.

The serological properties of human strains were tested in regard to their relation to sera from tropical typhus convalescents and to sera from rabbits immunised with *Proteus X 19*. The mucoid consistency of the majority of human strains is, to a great extent, responsible for their low agglutinability even with homologous rabbit sera. A positive agglutination to dilutions of 1/400, with sera from typhus patients has, up to the present, been obtained with only three of the human strains. None of the human strains was agglutinated by the anti-*X 19* rabbit sera, except in one instance when a "smooth" spreading variation of the culture No. 18 was agglutinated by the *X 19* immune serum to a dilution of 1/800.

Cultures have been also obtained from laboratory animals inoculated with human virus or with cultures isolated from human patients. In these cases blood or organs were inoculated into the liquid medium described above, and subcultures made on "chocolate" agar. The number of strains cultivated from infected animals totals 40, including 24 from guinea-pigs, 12 from rats and 4 from rabbits. Two morphological types can be distinguished—the coccal, or diplococcal, form and the slender "diphtheroid" bacilli. Among these cultures three strains, isolated from a guinea-pigs and two rats infected with human virus, showed serological relation to *Proteus X 19*. being agglutinated by rabbit immune sera "K" and "W" in dilutions up to 1/800 and 1/1600. The rats cultures were also agglutinated by sera of other rats, infected with typhus, in dilutions up to 1/800. Some cultures, isolated from infected guinea-pigs, showed no relationship to *Proteus X 19*, but when inoculated into rabbits, produced in them a rise of agglutinins for *X 19* from 0 to 1/125.

### Pathogenic Properties of Cultures.

The human strains showed low virulence for guinea-pigs when inoculated intraperitoneally but produced a marked decline of body-weight, and death after about 11 days when inoculated intra-scrotally. Autopsy revealed a normal spleen, enlarged testicles, congestion of the tunica vaginalis, congested lungs and brain. Sections of the brain showed the perivascular infiltrations and nodules as in guinea-pigs infected with original human virus. Human cultures inoculated into rats either intraperitoneally or intra-scrotally produced no febrile reaction but the morbid anatomy was similar to that described for guinea-pigs. The Weil-Felix reaction of some of these rats was positive up to dilutions of 1/250. Some cultures isolated from rats and rabbits, infected with human virus, proved to be extremely virulent for guinea-pigs and rabbits, especially the strain cultivated from a rabbit, inoculated with an emulsion of lice, which had been fed on typhus patients. The guinea-pigs, inoculated intraperitoneally with this strain, showed no fever, but lost weight and died in a few days, showing the pathological lesions described above. Smears from the tunica vaginalis showed a large number of minute coccal organisms, situated mostly intracellularly. The few examples of infection of laboratory animals with cultures, isolated from tropical typhus cases, thus showed pathological conditions identical with those of experimental tropical typhus.

### Complement Fixation.

Complement fixation tests were carried out repeatedly on sera from 35 human cases, emulsions of *Proteus X 19* "W" and "K", and suspensions of finely ground brain and liver being employed as antigens. These organs were obtained from fatal human cases and from passage guinea-pigs kindly supplied by Dr. L. Anigstein. The antigenic dose was adjusted to one quarter of the quantity that adsorbed completely 2½ m.h.d. of complement. Altogether some 70 tests have been undertaken with these antigens, sera having been obtained from the sixth to the thirty-third day of the disease.

Reactions with the bacillary emulsions were occasional only, and rarely was more than a "trace" reading obtained. There was no indication of increasing positivity in the later stages of the disease and sera from cases of the "K" serological type tended to react with both "K" and "W" emulsions. Among the organ antigens, brain emulsions gave the most promising results, but complete fixation occurred practically never. Some degree of reaction was usual on the sventh to the tenth day, though, in other cases, tests were quite negative as late as the twenty-fifth day. Generally, but by no means invariably, positivity increased with the duration of disease. The liver antigens gave results parallel to those obtained with brain emulsions, but of less degree.

All cases with positive Wassermann reactions were excluded from the series. It is of interest that tropical typhus tends to give a partially positive Kahn reaction.

### The Leucocyte Count.

Nearly one hundred total and differential leucocyte counts have been undertaken on upwards of 30 cases of tropical typhus in order to arrive at the leucocytic picture.

During the first few days it would appear that a leucopenia is a common feature but observations in the first week have been few in number. By the beginning of the second week the total leucocytes rise to about 8,000 p.c.mm. but in the third week a fall to about 7,000 p.c.mm. occurs. These figures are averages of several observations; there may be considerable individual variation. Sometimes leucopenia extends well into the third week, or the onset of bronchitis, with secondary infection, determines marked leucocytosis.

Except when septic complications supervene, the polymorphonuclear cells form a low percentage of the total count. An average of the figures obtained indicates that this type accounts for about 55 per cent. of the total during the first week. The figure rises to around 60 in the second week, to fall to below 50 in the third week, after which there is a gradual rise. Lymphocytes average about 40 per cent. until the third week when there is a increase to nearly 50 per cent. Later a gradual fall occurs. The large mononuclears show a slight but steady increase of one or two per cent. during the first three weeks, but eosinophils tend to fall.

## Epidemiological Observations.

The following observations on the epidemiology of tropical typhus are the result of an analysis of cases which occurred during 1927, 1928 and the first part of 1929.

The disease is not seasonal. Cases have occurred in every month of the year during the period under review. Nor was incidence apparently affected by rainfall during the period. In Malaya the months of May, June, July and August are usually drier than the earlier and later months; and during this middle period of the year incidence has fallen slightly. The significance of this fall is, however, doubtful, and is quite overshadowed by the important rôle that occupation plays in determination of incidence.

The racial incidence is at first sight remarkable, as the following figures shew, but no less than 121 of the 139 cases of Tamil race occurred on the oil-palm estate where the disease is endemic:

| | Europeans. | Malays. | Chinese. | Tamils. | Pathans. | Sikhs. |
|---|---|---|---|---|---|---|
| Percentate population at 1921 census (approx.) ... ... | 0.5 | 40 | 38.5 | 20 | 1 | |
| Incidence in 164 cases— | | | | | | |
| "K" type ... ... ... | 3 | 2 | 2 | 139 | 2 | 6 |
| "W" type ... ... ... | 2 | 0 | 0 | 6 | 0 | 2 |

The reluctance of both Malays and Chinese to seek admission to hospital is well known. But this is not of such degree as altogether to account for the disparity in incidence. It is, rather, employment in some particular kind of work, and, in certain instances, in some particular focal area of infection that is the deciding factor.

Sex and age are similarly determined. In this series, males numbered one hundred and twenty-three, females only thirty-one. On the oil-palm estate no patient was below working age; amongst the cases from other parts of Malaya there was only one patient of less than eighteen years of age, and he was a boy, aged four and a half years, living in a newly-built house on a rubber plantation in the State of Pahang.

The tendency to differing occupations of the victims of the "W" form on the one hand and the "K" form on the other, noted by Fletcher and Lesslar early in their investigations, continues to be evident in a proportion of the cases. In the present series there were ten "W" cases. Three were employed as coolies in small congested food shops, such as abound in every eastern town and village. Two more were also indoor workers, one being a clerk in a Government office, and one a factory-hand on the oil-palm estate mentioned previously. The remaining five consisted of a bullock-cart owner; a European electrician who, for fourteen days prior to illness had been superintending daily the erection of a high-power transmission system over a jungle route; a European rubber planter; a Sikh of the educated class, engaged in the field for some months previously in surveying the course of the Selangor River; and lastly an unemployed Tamil cook. The distinction in occupation between "W" and "K" forms of tropical typhus, that the "W" patients are usually indoor workers, and the "K" patients out-door workers, is thus not an absolute one, but it is nevertheless striking that of some three hundred cases of tropical typhus of the "K" form reported since the year 1926, not one has been an indoor worker.

Within the endemic on the oil-palm estate the significant disparity of incidence amongst the various groups of labour continues to obtain. It was shewn in detail in the previous Report that the labour force on this estate fell into four groups according to the various types of work that are necessary in the cultivation of the oil-palm; that the field workers alone contracted tropical typhus; and that incidence was highest amongst the comparatively small group of coolies employed in pruning and harvesting. From a review of the progress of the disease on this estate the following features have emerged: firstly, that with the commencement of pruning incidence soars; and secondly, that as pruning is completed and the number of coolies so employed therefore diminished, incidence declines. The progress of the outbreak on two separate oil-palm areas of the estate demonstrated these features so strikingly that the disease may almost be said to have shifted from the one area to the other. Thus on the first area pruning of the palms was in full swing in 1926, when tropical typhus was first recognised there, and continued until the second half of 1928. During this period the incidence of the disease was high, especially amongst the pruning coolies, less so amongst the weeding coolies. In the latter months of 1928, the pruning of most of the trees on this area having been completed, the number of pruning coolies dwindled and, concurrently, incidence fell. But during these same months pruning was begun for the first time on the second area, planted four years later than the first; and at once incidence soared. Whereas this area had in the twenty months prior to pruning yielded only six cases of typhus, it furnished thirty-two cases in the subsequent eight months. Yet the only addition to the one hundred and sixty coolies already working on this area was fifteen to twenty pruning coolies.

As set forth in the previous Report, the process of pruning involves the hacking off and handling of the decaying male and female flowers, the bunches of over-ripe fruit and lower leaves that have been lying in damp and shade at the base of the maturing palm tree: it would seem that the institution of this process was the determining factor in the sudden rise in incidence, and that completion of the process determined the coincident fall. It may be that in such decaying material a vector may flourish; possibly the decaying pollen of the dead male flowers harbours mites much as foodstuffs may. That rats are attracted to this material the gnawed bunches of fruit at the base of the tree afford clear evidence, but rats feed readily on the palm fruit and are thus always attracted to the bearing palm. Another explanation may be that the weeding of that lallang and undergrowth growing within a radius of two or three feet from the base of the tree can be done thoroughly only when the pruners have stripped the base of the tree; and that contact with this hitherto only partially accessible lallang and undergrowth increases exposure to infection.

Another feature of this endemic has been the complete immunity afforded, at least for two and a half years, by one attack of the disease. A gang of pruning coolies began work on 1st February. They numbered twenty-eight, of whom seven were known to have suffered from the disease at one time or other since 1st January, 1927. During the lapse of eleven weeks, ten of the twenty-one susceptible coolies had become infected, whereas all seven of the presumed immune coolies escaped infection.

## The Rat as a Reservoir of Infection.

Fletcher and Lesslar have previously suggested that rats possibly acted as a reservoir of the virus of tropical typhus. A systematic examination of these rodents, caught on the oil-palm estate where tropical typhus persists in endemic form, was carried out. Eighty rats were examined, and in six pathological changes in the testicles were found, consisting of haemorrhagic exudate in the tunica vaginalis. Smears made from this tissue revealed micro-organisms which bore a striking resemblance to those found in experimentally infected guinea-pigs, namely, slender Gram-negative organisms resembling *C. diphtheriae* in arrangement. The number of these micro-organisms was, in two rats, enormous, the appearance simulating smears from a culture. Two of the strains cultivated from rats showing testicular reaction deserve special attention. They appear in the form of slender Gram-negative organisms resembling *C. diphtheriae* in their arrangement and when plated, spread on the plate in Proteus-like form. One of them was agglutinated by the *X 19* "K" serum to a dilution of 1/200, the other to a titre of 1/1600. The sera of 18 of these rats were tested for the Weil-Felix reaction with a result that strains "W", "H" and "O" were agglutinated in one instance up to a titre of 1/250. This was of particular interest because the rat presented a marked testicular reaction, with the above mentioned microscopical findings in smears of the tunica vaginalis. All the other rats' sera failed to agglutinate *Proteus X 19*, or agglutinated very slightly in dilutions of 1/25, or a few to a 1/50 titre. These preliminary results indicate that rats from this endemic area occasionally show testicular lesions analogous to those in guinea-pigs infected with tropical typhus. The positive Weil-Felix reaction is a further argument in favour of probable natural infection of the Malayan rat with the virus of tropical typhus. It is necessary to add, however, that cases of an allied disease, Japanese river fever, have also occurred on the estate.

## Attempted Transmission of Infection by Body and Head Lice.

The body-louse, *Pediculus humanus corporis* deGeer, is not present in Malaya as far as can be ascertained by the examination of a large number of coolies, nor does it seem to be known among Malays. Dr. Enid Robertson kindly provided extracts from her records of the examination of over six thousand school children of various nationalities, which showed that although the head-louse was common, the body-louse was absent.

Under these circumstances, Dr. Anigstein brought a consignment of body-lice from Poland, where they had been bred in the R. Weigl Institute for some ten years. These were handed over to the Division of Entomology for breeding, and the strain was successfully carried on, using a specially employed Tamil for feeding, and incubating the lice at a temperature between 32° and 33°C. Batches of these lice were fed on tropical typhus patients, and smears were later made from the gut of these lice, stained by Giemsa and examined. Only in a small percentage of lice were micro-organisms found and these were in a form of minute purple-stained cocci morphologically like *Rickettsias*. A number of these lice were emulsified and inoculated intra-peritoneally into guinea-pigs. Two of three guinea-pigs died after 20 days with no rise of temperature but with a loss of body-weight. Post-mortem examination showed a normal spleen, enlarged and injected suprarenal glands and swelling of the testicles, with haemorrhagic exudate in the tunica vaginalis. From the spleen a pleomorphic organism was cultivated; in form a "diphtheroid" bacillus, changing later to thread-like forms, and finally to minute diplococci. Sections of the brains of these guinea-pigs showed perivascular infiltrations and typical nodules in the cortex. Further passages with blood or brain reproduced analogous signs up to the fourth generation. The next series of experiments in this direction were carried out with head-lice collected from tropical typhus patients (Tamils) and the results of animal inoculations were practically the same.

## The Search for the Local Vector.

The transmission by body and head lice has been successful under experimental conditions, but such vectors cannot function to any degree in the local spread of tropical typhus. The body-louse is, as far as observations go, non-existent, and transmission by head lice would be at variance with the epidemiological observations on the oil-palm estate. Mr. B. A. R. Gater has worked on the three following aspects of the problem with a view to narrowing the field.

Examination of coolies: Twenty-three typhus patients in the District Hospital were minutely examined, without result, for signs of arthropod attack. During the last quarter, an opportunity of examining coolies as soon as they came in from work among the oil-palms in the endemic area was generously provided by the management of the estate. A batch of coolies engaged on pruning work was mustered, every available day, directly they had finished work in the field. Each coolie was then stripped and examined by two assistants provided with magnifying glasses. In all, 464 examinations were made over a period of three months, with the result that eighty-eight arthropods were collected, the majority of which were larval Trombidiidae. The most interesting fact which emerged was that the commonest mite on man during this period was *Trombicula akamushi* Brumpt, and since Japanese river fever has already occurred in this area, it would appear that this species is more likely to be the vector than *T. deliensis*, as might be assumed from the examination of rats only.

Of the twenty-three coolies examined during this investigation, two had previously suffered from typhus and were considered to be immune. Two contracted the disease during the period of observation, but no definite relation with the arthropods found on them could be established.

Mites in oil-palms: At the beginning of the year monthly collections of mites from the decayed male flowers of oil-palms were commenced. This material again yielded large numbers of mites, but in this country, owing to the absence of literature and types for comparison, there was no opportunity of identifying the great number of forms met with, a large percentage of which is probably undescribed. Dr. Guy A. K. Marshall, C.M.G., F.R.S., Director of the Imperial Bureau of Entomology, very kindly endeavoured to find someone in Europe who would undertake the work of identifying the mites. His efforts were unsuccessful, however, owing to the great shortage of competent acarologists, and these collections were therefore abandoned. Enough mounted material was retained to indicate whether or not a mite found on a coolie on the estate had its origin in the oil-palm.

Ectoparasites of rats: Six hundred and sixty rats from Kuala Lumpur and from the oil-palm estate, *Rattus rattus diardi* (Jentink) and *R. r. jalorensis* (Bonhote) and a few mice and shrews were examined for ectoparasites. The large number of ectoparasites carried by many of these rats, especially those coming from the town of Kuala Lumpur, made it impossible to prepare each specimen for identification. The sampling method had therefore to be adopted, a certain number of each group, which appeared to be similar under the Greenough microscope, being prepared for further examination. *Xenopsylla cheopis* Roths. was almost the only flea found, the plague-flea index rising to four in September. Protonymphs of a species of *Dermanyssus* were found on a few rats and *Trombicula deliensis* Walch was common, especially on rats from the oil-palm estate. A paper on the ectoparasites of Malayan rats is in course of preparation and five new species of larval Trombidiidae will be described. In all, twenty-one species of ectoparasites have been recognised.

## MALARIA.

During the first-half of the year researches were undertaken by Dr. R. Green in connection with factors which influence the infectivity of malaria gametocyte carriers to *A. maculatus* Theo., one of the principal malaria carrying anophelines in this country.

Investigations were carried out on the following problems :

(i) What is the minimum number of gametocytes in the peripheral blood required to infect *A. maculatus* with the three species of malaria parasites?

(ii) How long is it necessary for the public health to treat a malaria patient in hospital?

(iii) What is the influence on infectivity of the carrier to the mosquito of (*a*) the presence of fever, (*b*) the haemoglobin content of the blood, (*c*) the presence of splenic enlargement and (*d*) the proportion of male to female gametocytes?

(iv) It is known that long courses of quinine are necessary to cause the disappearance of all gametocytes from the blood of a crescent carrier. Does the action of quinine affect the viability of gametocytes, so causing modification or arrest of development in the mosquito?

### Conditions of Experiment.

Eighty-three gametocyte carriers were selected for mosquito feeding experiments. Of these, 45 were Tamils, 32 were Chinese, and 6 were Sikhs. There were 30 cases with gametocytes of *P. falciparum* in the blood, 20 with *P. vivax*, 21 with *P. malariae* and three with mixed gametocytes. The standard treatment was 30 grains of quinine hydrochloride, given in two 15 grain doses, night and morning.

Mosquitoes, supplied by the Entomological Division (*see* below) were applied in batches of ten, for a period of thirty minutes, commencing two hours after the morning dose of quinine. Those that had taken blood were separated for subsequent dissection. Of the survivors, half were dissected after an interval of seven days and the remainder after sixteen to eighteen days.

In all, 1,130 *A. maculatus* were applied on 113 occasions. Of these, 890 mosquitoes, or 77 per cent. were observed to have taken blood; but 43, or 3.8 per cent. of the whole, died before a suitable dissection interval. The remaining 847 mosquitoes, or about 73 per cent. were eventually dissected and examined for evidence of infection.

For the enumeration of parasites and leucocytes the fowl corpuscle method of Sinton was employed. Ordinary thin films, stained with Giemsa, were used for the estimation of the proportion of male to female gametocytes. A standard Dare haemoglobinometer was employed for haemoglobin estimations.

### A.—Numerical Factors.

#### (*a*) *Gametocytes of P. falciparum.*

(i) Of the total number of 258 mosquitoes which took blood and finally survived for dissection, 112, or 43 per cent. were found to be infected.

(ii) Immature öocysts were found among 82.7 per cent. of the infected batches (average 7.7 immature öocysts per infected midgut). Mature öocysts (average 5.3 per infected midgut) were found among 25.7 per cent. of the infected batches.

(iii) Sporozoites in the salivary glands were found among 74.3 per cent. of the infected batches of mosquitoes.

(iv) The gametocyte content of the blood when positive results were obtained ranged between 42 and 8,540, with an average of 1,281 per c.mm. of blood. In the negative series the gametocyte content ranged from 12 to 2,310, with an average of 415 per c.mm. of blood.

#### (*b*) *Gametocytes of P. vivax.*

(i) Of the total number of 56 mosquitoes which took blood and finally survived for dissection 22, or 39 per cent. were found to be infected.

(ii) Immature öocysts were found among 75 per cent. of the infected batches of mosquitoes, average 5.4 per infected midgut; while 62.5 per cent. had mature öocysts (average 1.2 per infected midgut).

(iii) Sporozoites in the salivary glands were found among 62.5 per cent. of the infected batches of mosquitoes.

(iv) The gametocyte content of the blood, when infection resulted, ranged between 10 and 400, with an average of 142 per c.mm. In the negative series, the gametocyte content ranged from 5 to 900, with an average of 177 per c.mm.

### (c) *Gametocytes of P. malariae.*

Of the total number of 160 mosquitoes which took blood and finally survived for dissection, only 14, or 8 per cent. were found to be infected. These 14 mosquitoes showed immature öocysts only; mature öocysts or sporozoites were not found.

The findings are given in tabular form below:

TABLE I.

| Particulars. | *P. falciparum.* | | *P. vivax.* | | *P. malariae.* | |
|---|---|---|---|---|---|---|
| | Positive series. | Negative series. | Positive series. | Negative series. | Positive series. | Negative series. |
| Range of number of gametes per 100 leucocytes ... | 0.5 to 141 | 0.13 to 60 | 0.1 to 12 | 0.05 to 12 | 0.3 to 4 | 0.2 to 6 |
| Averages ... | 25.7 | 7.3 | 3.1 | 3.2 | 2.2 | 1.2 |
| Range of number of gametes per cubic mm. of blood... | 42 to 8,540 | 12 to 2,310 | 10 to 400 | 5 to 900 | 27 to 168 | 7 to 300 |
| Averages ... | 1,281 | 414.9 | 142.3 | 177.3 | 97.5 | 76.4 |
| Number of cages of *A. maculatus* fed on gamete carriers ... ... . ... | 35 | 37 | 8 | 11 | 2 | 20 |

From the above findings, it was concluded that crescent carriers whose blood contained 42 or more gametocytes per c.mm. of blood were potential infectors of *A. maculatus*. Similarly, for *P. vivax* the lowest infective limit was regarded as 10 per c.mm. of blood. The results obtained with quartan gametocyte carriers do not justify an opinion as to the lowest infective limit for *P. malariae* carriers.

## B.—Factors in the Gamete Carrier (Other than the Number of Gametes) Possibly Influencing Infectivity.

These factors varied so considerably that any attempt to correlate is regarded as inadvisable, since direct controls in all particulars were not obtainable. The results of the experiments, however, showed tendencies in certain directions which, while not affording proof, give indication that certain factors appear to increase or decrease infectivity of the carrier to the mosquito.

### (a) *Variations in the Proportion of Male to Female Gametocytes.*

Taken in conjunction with the number of gametes present in the blood only, the evidence for or against reduction in infectivity of the gamete carrier, owing to a disproportionate ratio of male and female gametocytes, was inconclusive in sub-tertian and quartan gamete carriers; but, among cases with benign tertian gametocytes there appeared to be some evidence of reduced infectivity when the females are greatly in excess of the males.

### (b) *The Presence of Numbers of Young or Abnormal Gametes.*

Extensive observations in this connection were only possible with the sub-tertian gametocyte carriers. In a number of both positive and negative cases a high proportion of young forms, or apparently degenerate forms, were seen, the latter staining imperfectly, containing no visible chromatin, and pigment being in fine rods and blocks irregularly distributed throughout the protoplasm. In some cases, with high proportion of abnormal forms, a large number of gametes appeared to compensate, but in other cases, on which repeat batches of mosquitoes were fed, the proportion of abnormal forms varied greatly from one feeding to the other. Though no direct evidence on this point was obtainable, a general survey of results tends to show that, where the number of gametes approaches the lowest limit of infectivity, a high proportion of young or abnormal forms is a factor in reducing infectivity.

### (c) *The Influence of Fever in the Gamete Carrier at the Time of Feeding Mosquitoes.*

The following table (No. II) shows, among positive and negative cases with sub-tertian, benign tertian and quartan gametes, the percentage incidence of fever and its highest degree at the time of feeding mosquitoes:

TABLE II.

| Particulars. | Positive cases. |  | Negative cases. |  |
|---|---|---|---|---|
|  | Percentage incidence. | Highest temperature recorded. | Percentage incidence. | Highest temperature recorded. |
| Fever occurring when mosquitoes fed—*P. falciparum* | 3 | 99°F. | 11 | 100°F. |
| Fever occurring when mosquitoes fed—*P. vivax* | 50 | 104.4°F. | 55 | 101°F. |
| Fever occurring when mosquitoes fed—*P. malariae* | 50 | 99°F. | 45 | 103.8°F. |

It was concluded from these results that the occurrence of fever, and its degree at the time of feeding, has little or no effect on subsequent development in the mosquito.

### (d) *The Presence of Trophozoites as well as Gametes in the Patient's Blood at the Time of Feeding.*

The percentage incidence of trophozoites among the positive and negative cases at the time of feeding is given below (Table III):

TABLE III.

| Particulars. | Positive cases. | Negative cases. |
|---|---|---|
| Trophozoites occurring with gametes of *P. falciparum* | 14% | 27% |
| Trophozoites occurring with gametes of *P. vivax* | 100% | 91% |
| Trophozoites occurring with gametes of *P. malariae* | 100% | 90% |

There is thus no indication that the presence of trophozoites affects subsequent conjugation and development.

### (e) *The Effect of Variations in the Haemoglobin Content of Ingested Blood.*

The range of the haemoglobin content and averages among positive and negative cases are shown in Table IV:

TABLE IV.

|  | Positive cases. |  | Negative cases. |  |
|---|---|---|---|---|
|  | Range. | Average percentage. | Range. | Average percentage. |
| Haemoglobin percentages occurring with gametes of *P. falciparum* | 15 to 55% | 42.9% | 12 to 55% | 42.3% |
| Haemoglobin percentages occurring with gametes of *P. vivax* | 30 to 55% | 42.5% | 30 to 70% | 45.6% |
| Haemoglobin percentages occurring with gametes of *P. malariae* | 30 to 35% | 32.5% | 20 to 60% | 39.6% |

Thus infection of the mosquitoes occurred quite irrespective of the percentage of haemoglobin in the carrier's blood.

### (f) *The Size of the Spleen in the Gamete Carrier.*

It was considered that splenic enlargement, with its relationship to immunity, might have some relationship to alteration in viability of the gametocytes.

The following table (No. V) gives particulars of the results observed :

TABLE V.

| Particulars. | Positive cases. |  | Negative cases. |  |
|---|---|---|---|---|
|  | Percentages. | Average enlargement among these cases. | Percentages. | Average enlargement among these cases. |
| Enlarged spleen with gametes of *P. falciparum* | 22.9% | 5.7 cm. | 43.2% | 5.8 cm. |
| Enlarged spleen with gametes of *P. vivax* | 37.5% | 5.7 cm. | 45.5% | 4.2 cm. |
| Enlarged spleen with gametes of *P. malariae* | 50% | 9.5 cm. | 85% | 8.15 cm. |

With regard to the percentage with splenic enlargement occurring among cases which infected *A. maculatus*, it is evident that the spleen rate is of little value as an indicator of infectivity.

(*g*) *The Leucocyte Count in the Gametocyte Carrier at the Time of Feeding Mosquitoes.*

Ingestion of sub-tertian gametes by human leucocytes in the midgut of the mosquito has been observed by Darling and others. The number and phagocytic power of leucocytes in the blood of the gamete carrier may therefore be of importance in the transmission of the plasmodia from man to mosquito. It was not possible to investigate the question of the phagocytic power of the leucocytes in the present series of cases, owing to the large number of anophelines which would be required for such work; but it is hoped to carry out experiments on these lines at a later date. Leucocyte counts were however performed on each case at the time of feeding, by the fowl corpuscle method.

The following table (No. VI) gives the figures obtained:

TABLE VI.

| Particulars. | Positive cases. |  | Negative cases. |  |
|---|---|---|---|---|
|  | Range. | Average. | Range. | Average. |
| Leucocytes per c.mm. with gametes of *P. falciparum* | 2,160 to 10,000 | 5,493 | 3,300 to 12,500 | 6,424 |
| Leucocytes per c.mm. with gametes of *P. vivax* | 3,300 to 20,000 | 7,904 | 3,300 to 9,000 | 6,045 |
| Leucocytes per c.mm. with gametes of *P. malariae* | 4,200 to 9,000 | 6,600 | 3,300 to 18,000 | 6,600 |

From these results, and from a study of individual cases, no conclusive evidence is forthcoming that a high leucocyte count tends to decrease infectivity.

## C.—The Influence of Quinine Treatment on the Infectivity of Gametocyte Carriers to A. maculatus.

The results of experiments relating to the viability of gametocytes of *P. falciparum*, *P. vivax* and *P. malariae* after quinine treatment of the carriers are given in the table (No. VII) below:

TABLE VII.

| Particulars. | Positive cases. |  |  |  |  | Negative cases. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
| Gamete carriers given quinine. | Percentage of cases given previous quinine treatment. | Number of days of quinine treatment. | Average days. | Number of grains of quinine given. | Average grains. | Percentage of cases given previous quinine treatment. | Number of days of quinine treatment. | Average days. | Number of grains of quinine given. | Average grains. |
| *P. falciparum* | 100% | 0.3 to 16 | 5.8 | 10 to 480 | 172 | 100% | 0.3 to 18 | 4.9 | 10 to 540 | 147 |
| *P. vivax* | 50% | 0.3 to 1.3 | 0.75 | 10 to 40 | 22.5 | 81% | 0.3 to 4 | 1 | 10 to 120 | 32 |
| *P. malariae* | 100% | 0.3 to 1.3 | 1.2 | 30 to 40 | 35 | 80% | 0.3 to 3 | .85 | 10 to 90 | 26 |

It was found that certain gametocyte carriers under quinine treatment were non-infective, but later, and after continued treatment, they became infective.

In the case of *P. falciparum* gamete carriers undergoing the quinine treatment generally adopted in Malaya (gr. x. thrice daily) the rate of reduction of gametes in the blood is slow and irregular, and the viability of the gametes is unaffected if quinine is given up to two hours before mosquitoes are fed. Patients receiving quinine in these doses may be infective to *A. maculatus* up to the sixteenth day of treatment.

With *P. vivax* gamete carriers the viability of the gametes is not affected by the usual doses of quinine given up to 24 hours previously. It is probable, however, that continued quinine treatment reduces their number with sufficient rapidity to render the drug of epidemiological value under local conditions of dosage and treatment.

The results of mosquito infection experiments with quartan gametocyte carriers were inconclusive. As with benign tertian carriers, however, the effect of quinine in reducing the number of quartan gametes is thought to be sufficiently rapid to render the patient non-infective after a fairly short interval.

## Practical Application of Results.

With *P. falciparum* it has been shown that one gametocyte per 200 leucocytes, or 42 per c.mm., is the probable lowest limit at which the blood of the carrier is infective to *A. maculatus*. If ordinary thin blood films are used, a period of about 20 minutes would be required in order to count 200 leucocytes and to examine the volume of blood represented thereby. For accurate results at least 400 leucocytes should be counted, requiring about 40 minutes. It is obviously impossible in hospital practice to devote this time to each case. The use of thick films would permit of the examination of from 20 to 30 times as much blood in the same microscopical field. If the preparation and interpretation of thick blood films is properly understood, and applied to cases from the point of view of infectivity, examination for five minutes would suffice to ascertain if, in the case of *P. falciparum*, the patient is capable of infecting mosquitoes.

It is suggested that, if the policy of retaining patients in hospital until they can be regarded as non-infective, is practicable, discharge should not be permitted until thick blood films have been found negative on three alternate days.

## The Value of Quinine in the Epidemiology of Sub-tertian Malaria.

The rapidity with which quinine destroys trophozoites and relieves the symptoms of the patient cannot be in doubt. From the epidemiological point of view, however, its use is less effective than is generally recognised. The fact that a patient is receiving, or has received, quinine does not justify a belief that he is therefore no longer a source of danger to the community. Such belief brings an entirely false sense of security which must inevitably retard the progress of malaria control.

We have seen that sub-tertian cases may be infective to mosquitoes even after many days of quinine treatment, and that occasional cases, non-infective in the early part of the course, may later become infective. Examination of a special series of sub-tertian cases at the District Hospital, Kuala Lumpur, has indicated that on admission 39 per cent. were potentially infective. After quinine exhibition (gr. xxx. daily) varying from 5 to 14 days in duration (average 7 days) this percentage had risen to 53.

Following these results, it would at first appear that quinine tends to increase the infectivity of sub-tertian cases, possibly by inducing the plasmodium to assume the more resistant gametocyte phase. Further investigation was imperative and the problem was reapproached by Dr. C. Russell Amies from a different route. During the period September to December alternative sub-tertian admissions to hospital were treated by quinine hydrochloride gr. xv. at 8 a.m. and again at 4 p.m. A second series received a simple diaphoretic mixture only. Severe cases were excluded on the grounds that vomiting, delirium, etc., precluded exact experimental conditions. On each day at 10 a.m. thick blood films were taken from each patient, again using the fowl corpuscle method. In this way it was possible to estimate the daily variations of the number of gametocytes under the two methods of treatment employed.

Up to the present, 73 cases have been studied, but 27 of these had to be rejected as they did not complete the minimum period of seven days' treatment, owing to absconding or insisting upon being discharged. The numbers are therefore reduced to 28 quinine cases and 18 control cases.

### (1) *Patients Taking Quinine.*

At the beginning of the period of observation, 26 out of 28 cases, or 93 per cent., showed a crescent count above 42 c.mm. and were thus potentially infective to *A. maculatus*. On the seventh day of treatment, 24 cases, or 85 per cent., remained infective. The average period of treatment for the 28 cases was 12 days. Eleven patients were discharged with less than 42 crescents per c.mm. of blood but the remaining 17 were still potentially infective. Thus, after an average period of 12 days of quinine treatment the number of cases regarded as infective fell from 93 to 60 per cent.

### (2) *Patients Taking no Quinine.*

Among the 18 patients who were given the diaphoretic mixture only, 16, or 88 per cent., were potentially infective to *A. maculatus* at the commencement of the period of observation. On the seventh day, 15 cases, or 83 per cent., remained infective. The average period of treatment for the 18 cases was 10 days: 9 of these patients were discharged with less than 42 crescents per c.mm. of blood, but the remaining 9 were still potentially infective. Thus, after an average period of 10 days treatment with a diaphoretic mixture and no quinine, the number of cases regarded as infective to this mosquito had fallen from 88 to 50 per cent.

These results are very similar to those obtained by Thomson and Ross (1910).

The results obtained from these smaller series of cases differ somewhat from those given by the analysis of the 250 cases reported in Bulletin from the Institute for Medical Research, No. 3, 1929. The findings of the latter report can be briefly restated as follows: Two hundred and fifty cases of sub-tertian malaria received the standard hospital treatment of 30 grains of quinine daily. At the commencement of this treatment, 39 per cent. of these cases were potentially infective to mosquitoes, and, after treatment varying from 5 to 14 days, with an average of 7 days, 53 per cent. of the cases were potentially infective. It thus appeared that this relatively short course of quinine treatment had produced an increase of 14 per cent. in the number of cases capable of transmitting infection to suitable anophelines.

The second, though smaller series, shows a decrease of 8 per cent. in the number remaining infective after a seven days' course of quinine. Possibly these rather contradictory results are explicable by differences in the conditions of the two series which were undertaken at different times of the year. In the case of the larger series of 250 patients, quinine was not administered by the laboratory staff. The labouring class of patient is averse to taking bitter tasting medicine and will often, if an opportunity offers, throw his quinine mixture into the nearest drain. It is also not uncommon for a patient voluntarily to vomit the dose of quinine which he took a short while before. Yet a decrease also occurred in the small control series treated only by a diaphoretic mixture.

Two other points of importance are disclosed by an analysis of the daily crescent counts of the later series of cases. It was found in many of the cases that the gametocytes increased or decreased by as much as 100 per cent. during a 24 hours period. For example, one quinine case had only 30 crescents per c.mm. on the tenth day and was thus non-infective to mosquitoes. The crescent count 24 hours later was 120 and on the twelfth day it had risen 180 per c.mm. of blood. It follows that a single enumeration of the gametocytes in the blood is insufficient to determine whether or not a patient is infective.

The second point is seen by a consideration of the variation in the actual numbers of gametocytes in the blood. In another quinine case, for example, the crescent count during the first seven days of treatment fell from 750 to 120 per c.mm. of blood. On the seventh day of treatment the patient was therefore still infective to mosquitoes. With 120 crescents per c.mm. of blood the chances of infecting suitable mosquitoes would probably be less than when the count was 750. It is, therefore, of interest to calculate the proportion of increased to decreased gametocyte counts after 7 days treatment.

The figures obtained were as follows:

Quinine cases—

| | |
|---|---|
| Number of cases with an increased gametocyte count | 4 |
| Number of cases with a decreased gametocyte count | 24 |
| Total | 28 |

Control cases—

| | |
|---|---|
| Number of cases with an increased gametocyte count | 4 |
| Number of cases with a decreased gametocyte count | 14 |
| Total | 18 |

The numbers in these later series are as yet small but the number of gametocytes in sub-tertian cases has tended to fall over a seven day period, in cases treated either by quinine or by a diaphoretic mixture. With quinine, however, the figures are rather better than with the diaphoretic mixture. Thus the usual hospital treatment of sub-tertian malaria, though unsatisfactory, is not quite ineffectual from the epidemiological point of view.

### The Proportion of Sub-tertian Cases Infective to Mosquitoes.

It has been considered advisable to obtain data regarding the percentage of sub-tertian cases potentially infective to anophelines in this country. From June, 1928, to August, 1929, all such cases admitted to the District Hospital were examined by thick and thin film methods. The following table (No. VIII) shows the number of sub-tertian cases, month by month, the number of cases with crescents in their blood, and the number of crescent carriers with one or more gametes per 200 leucocytes—the latter group being regarded as potentially infective to *A. maculatus*. With a total of 1,063 cases the average percentage of infective sub-tertian cases throughout the period of examination was found to be 51:

TABLE VIII.

| Month. | No. of sub-tertian cases. | No. of crescent carriers. | Percentage of cases with crescents. | Cases with one or more crescents per 200 leucocytes. | Cases with less than one crescent per 200 leucocytes. |
|---|---|---|---|---|---|
| 1928. | | | | | |
| June | 117 | 73 | 62.4 | 58 | 15 |
| July | 145 | 85 | 58.6 | 64 | 21 |
| August | 82 | 41 | 50.0 | 38 | 3 |
| September | 70 | 33 | 47.0 | 32 | 1 |
| October | 74 | 38 | 51.4 | 36 | 2 |
| November | 45 | 23 | 51.0 | 22 | 1 |
| 1929. | | | | | |
| January | 33 | 21 | 63.6 | 21 | 0 |
| February | 30 | 16 | 53.3 | 15 | 1 |
| March | 27 | 16 | 59.3 | 16 | 0 |
| April | 44 | 21 | 47.7 | 21 | 0 |
| May | 74 | 42 | 56.8 | 42 | 0 |
| June | 108 | 62 | 57.4 | 57 | 5 |
| July | 95 | 63 | 66.3 | 63 | 0 |
| August | 119 | 59 | 49.6 | 59 | 0 |
| Totals | 1,063 | 593 | Av. 55.8 | 544 | 49 |

## The Relative Incidence of Albuminura among Cases of Benign Tertian, Sub-tertian and Quartan Malaria.

As there is some difference of opinion regarding the association of albuminuria with malaria, an investigation was carried out upon a series of cases by Dr. R. Green. These were grouped in accordance with the species of infecting plasmodium and compared with regard to incidence and degree of albuminuria.

Three hundred adult male patients were examined, most of whom were Tamils. Seventy of these were suffering from benign tertian, 159 with sub-tertian, and 71 with quartan malaria. The average weight among these cases was 108 lbs. (48 kg.) and the average age was 21 years. They received treatment in the form of gr. xxx (1.95 gm.) of quinine hydrochloride daily. The usual tests for albumen were performed upon a morning specimen of the urine, and cases were classed as "mild" or "severe" according to quantity and persistence of the reaction.

It was possible to keep 185 of the patients under treatment for a period of 7 days, and the remaining 115 patients for a period of 10 days. The results obtained are summarised in the following table (No. IX):

TABLE IX.

| Particulars. | | Type of malaria. | | | Total cases. |
|---|---|---|---|---|---|
| | | Benign tertian. | Sub-tertian. | Quartan. | |
| Number of cases examined ... | ... ... ... | 70 | 159 | 71 | 300 |
| Cases with "mild" albuminuria | Number ... | 17 | 59 | 35 | 111 |
| | Percentage ... | 24.3% | 37.1% | 49.3% | |
| Cases with "severe" albuminuria | Number ... | 1 | 8 | 7 | 16 |
| | Percentage ... | 1.4% | 5% | 9.9% | |
| Total cases with albuminuria ... | Number ... | 18 | 67 | 42 | 127 |
| | Percentage ... | 25.7% | 42.1% | 59.2% | |

In benign tertian, sub-tertian, and quartan malaria, the relative incidence of "mild" albuminuria was roughly as 24 : 37 : 49 respectively. For "severe" albuminuria, the incidence was 1 : 5 : 10. The quartan malaria series showed the highest proportion of cases; the benign tertian the lowest.

Before assessing the value of these results, it is necessary to consider two factors. One is the possibility of a "constitutional" albuminuria, and the other the action of quinine as a possible renal irritant. Whether a "constitutional" albuminuria actually exists among Asiatics is uncertain. Incidence would, however, be evenly distributed among the three groups and would not materially influence the comparison of the results.

Nierenstein has observed that the giving of over 30 grains of quinine daily to Europeans of average weight is apt to cause albuminuria. The above cases averaged 25 per cent. less in weight than the average male European; hence the dosage employed was equivalent to 35 to 40 grains of quinine per day for a European weighing 150 pounds. Loss of fluid by sweating, such as occurs in a tropical country, would also tend to increase the concentration of quinine in the urine. But the comparison of the results would be uninfluenced as this factor is constant for all groups. No direct relationship was found between the degree of albuminuria and the number of parasites in the blood.

## The Detection of Some of the Alkaloids of Cinchona in the Urine.

Consequent upon an enquiry from an outside source concerning the detection of euquinine (quinine-ethyl-carbonate) in the urine, an investigation was undertaken in this connection using Mayer's reagent as an indicator. Other alkaloids of quinine were also used during the experiment, and such points were investigated as the length of time elapsing before each drug could be demonstrated in the urine, subsequent to administration; the period when maximum excretion occurred, and the interval before demonstrable quantities ceased to be excreted. The conditions of the experiment were briefly as follows:

The drugs chosen for investigation were quinine alkaloid, quinine sulphate, quinine hydrochloride, quinine-ethyl-carbonate (euquinine) and cinchonine. Three healthy individuals were selected. Case 1 was a European weighing 150 lbs., Case 2 a Chinese weighing 128 lbs., and Case 3 a Tamil weighing 105 lbs. The drugs were given on each occasion in a single dose of 5 grains (0.32 grm.) in powder form, and administration was followed by the drinking of about half a pint of water. The time was about 8.30 a.m.—from one to one hour and a half after the morning meal. Following the administration of the drugs, urine was passed at intervals of twenty minutes during the first hour and subsequently every hour until 10 p.m. Urine passed on the following morning was also tested.

It is well known that when Mayer's reagent is added to urine containing alkaloids, a whittish opalescent cloud forms (which, if due to alkaloids, disappears on heating and reappears on cooling). The density of the cloud is generally in proportion to the amount of alkaloid present in solution. Accordingly, each specimen of urine was filtered: 10 c.cms. was reserved as a control, and, to another 10 c.cms. fifteen drops of Mayer's reagent were added. If a precipitate was observed, it was recorded according to its density. This method of testing was adopted as it was thought that a simple test, convenient to the clinician, was more desirable than the employment of the finer methods of detection. (Mayer's reagent consists of 6.8 grms. mercuric chloride, and 24.9 grms. of potassium iodide dissolved in 500 c.cms. of water.)

With quinine, euquinine and cinchonine, no reaction with Mayer's reagent was obtained until two hours after administration. Quinine sulphate was excreted in the urine forty minutes, one hour and two hours after it had been swallowed. Quinine hydrochloride appeared to be absorbed and excreted even more quickly and, in one case, it was detected in the urine twenty minutes after the ingestion of the usual five grain dose. In the other two cases it appeared forty minutes afterwards.

The period of maximum excretion, as estimated from density of the precipitate with Mayer's reagent, showed considerable variation, not only as regards the drug given, but also among the three individuals examined. With quinine alkaloid the maximum excretion appeared to take place between the third and eighth hour: with quinine sulphate between the third and ninth hour: with quinine hydrochloride between the second and fifth hour: with euquinine between the second and fifth hour: and with cinchonine between the second and seventh hour.

The drugs ceased to be demonstrable in the urine between nine and thirteen hours after administration. Excretion of quinine hydrochloride seemed to be completed more rapidly than that of the other drugs, while traces of quinine and cinchonine were still found between eleven and thirteen hours after the administration of the specified doses.

## MOSQUITO INVESTIGATIONS.

### Rice Fields.

The question of anophelism of rice fields is of local importance on account of the comparative absence of malaria in many rice areas. Year by year local observations have been recorded on the species of larvae, and the prevalence of various species at different stages of the crop. In the last Report mention was made of the proposed experimental rice plots of the Agricultural Department, and, thanks to the courtesy of the Director of Agriculture, it has been possible for Mr. B. A. R. Gater to follow the appearance or disappearance of the larvae of various species in the experimental tanks under controlled conditions.

The long projected series of experiments was started in July. Their object, from the agricultural point of view, was to start with "blank" soil, known to be a poor rice soil, and then to treat in various ways in order to observe the effect on the growth of the rice. A quarzite soil was selected for the purpose and placed in a series of cement tanks with arrangements for the control of water. After some preliminary trials, water was run into the tanks and seedlings were transplanted at the end of July. Previous to this, accumulations of rain water in some of the tanks provided breeding places for *Anopheles maculatus* Theo., *A. vagus* Dön. and *A. barbirostris* V. d. Wulp.

Investigations continued from this time until the middle of December, when the rice plants were pulled and the first portion of the experiment ended. The large number of tanks made it extremely difficult for the Chemical Division to perform more than one extended analysis of the water in every tank each month, but since the rate of flow of the water was controlled and constant, this was considered to be sufficient. In addition to analyses of the water from the fifty tanks, analyses of the reservoir supplying the water, and the source from which the water was pumped to the reservoir, were performed each month. Every tank was examined for larvae once in ten days or a fortnight, and it was proved by experiment that 78 per cent. of the larvae in each tank could be captured at each examination. In addition to the larval findings, the hydrogen ion concentration was taken at the time of examinations for larvae, and other data, such as temperature and depth of water, were recorded.

As far as anopheline mosquitoes were concerned, the dominant species throughout the experiment was *A. maculatus*, but *A. vagus*, *A. barbirostris*, *A. kochi* Dön. and *A. karwari* (James) also occurred. It must be strongly emphasized that these results do not indicate that *A. maculatus* is associated with the growth of a normal rice crop. As already stated, the rice was planted in a soil known to be very poor and possibly unsuited to it, in order to study the effects of various kinds of treatment. The growth of the crop was poor, and the conditions were obviously unsuited to it. From the point of view of larval oecology, however, the value of the observations lies in the change in fauna which might be expected to take place when the soil was treated in such a manner as to make it suitable for the growth of rice, and in correlating the change in fauna with the altered conditions. In the early part of this investigation a very suitable breeding-ground for *A. maculatus* was provided, and the large number of analyses, and other data, may at least give some idea of the conditions suited to this species. It is possibly significant that in twenty-three of the fifty tanks (46 per cent.) *A. maculatus* was the only species present from the beginning of July until a period between the middle of October and the end of November, when other species appeared in each of these tanks. It is too early to say if this significant change in fauna can be correlated with any radical difference in conditions as shown by the data recorded. To deal with the mass of figures involved will take time, and the results will be published as a separate communication.

## Trapping Experiments.

These experiments, foreshadowed in the Report for 1928, were actually started in February after a conference between Mr. B. A. R. Gater and Dr. C. Manalang of the Philippine Health Service, who had used a similar method. A trap consisting of a large outer mosquito net, with an arrangement whereby the sides could be opened from top to bottom, was placed at the end of a coolie line. Inside the large net was placed a camp bed with its own small net. The trap was rigged before dusk and an assistant lay on the camp bed until 7 p.m., when he got up, closed the outer net and collected all the mosquitoes thus trapped. He then opened the outer net and retired under the small net for two hours, when the procedure was repeated. In this manner catches were made at two-hourly intervals throughout the night. Of the following morning, two skilled collectors searched the rooms in the adjacent coolie lines for mosquitoes, and the two catches were then compared.

The most important, but not unexpected, finding was that many more specimens of *A. maculatus* were captured in the trap than in the lines, and that species not found in the lines were taken in the trap. This indicates that the theory that *A. maculatus* is not a house-frequenting species is correct, and that the searching of buildings in a mosquito survey may give a totally incorrect idea as to the prevalence of species: a fact which was pointed out some years ago by Dr. M. E. Barnes.

During this investigation the trap was set on 178 nights and 32,648 mosquitoes, of which 5,372 were anophelines, were captured and examined, while 11,083 mosquitoes, of which 622 were anophelines, were taken in the coolie lines. A short paper dealing with the results of these experiments will be published in due course.

## Revision of Species.

This was carried out with the object of establishing the true status of Malayan *Anopheles* and of providing materials for a manual by means of which accurate identifications could be made. Among the more important results, it was found that the species hitherto known in Malaya as *Anopheles fuliginosus* Giles, was much more usually another species, *A. philippinensis* Ludlow, but that the former occurred in small numbers in the North of Malaya. Various varieties of other species were recognised and one species was sunk as a synonym. Progress was also made in the separation of some very similar larval forms.

## Culicine Mosquitoes.

It was not possible, owing to the pressure of other work, to extend our knowledge of this group very much. Routine records were kept, however, and a proportion of these occurring in association with anopheline mosquitoes, in the rice experiments, was studied.

### Larvicides.

Through the kindness of Dr. Hamlyn Harris, a sample of *Cladophora holsatica* was obtained by Mr. B. A. R. Gater from Queensland. This plant is said to be associated with waters where mosquitoes do not breed and that it may in some way be inimical to larvae. The specimens received were damaged owing to the long journey, but were placed in an open aquarium on arrival. Although culicine mosquitoes are plentiful in the neighbourhood, no larvae were observed until just over six weeks after the plant had been placed in the aquarium, when larvae of *Aedes* (*Stegomyia*) *albopictus* Skuse appeared and developed to adults. Results were inconclusive since the plant did not grow well and finally died out.

Some further experiments with sodium and calcium silicofluoride were carried out in artificial containers, to ascertain if these substances could prohibit breeding for long periods, if used at low concentration. All the controls did not breed larvae, however, so the results, at the end of the year, were inconclusive.

### Relative Pathogenicity of Species.

Regular dissections of several species of *Anopheles* were carried on throughout the year, the specimens being taken on an estate where malaria is usually prevalent. Unfortunately for the investigation, the malaria rate in this area was phenomenally low, so few infected mosquitoes could be expected. Despite a break of some months owing to illness among the staff, 1,895 anopheline mosquitoes were dissected, but *A. maculatus* was the only species found infected.

### Experimental Infections.

Mosquitoes required by the Malaria Research Division for experimental feeding were provided by the Entomological Division, 1,350 *A. maculatus* being bred, fed on the patients provided, and maintained until dissection was performed. The opportunity was taken at the same time of feeding 355 *A. kochi* and later, 120 *A. philippinensis* were applied to human carriers. Records were kept of the variants of *A. maculatus*, of the breeding places from which the larvae were obtained, and of other factors which might influence susceptibility. The results have not yet been worked out, and owing to the large number of carriers used (*see* above), it will be difficult to draw any but very rough conclusions.

### Miscellaneous.

Through the Malaria Advisory Board, information was requested regarding any unusual breeding places of *A. maculatus* which came to the notice of Medical Officers on estates and elsewhere. Several interesting replies were received, and specimens of the larvae for permanent record were forwarded in each case. The small number of observations recorded tends to confirm the adaptability of this species.

A party was sent to Cameron's Highlands in May, with the object of collecting *Anopheles lindesayi* Giles var. *cameronensis* Edw., of which this is at present the only known locality, and to help the Health Branch in a survey of that area.

At the request of the Health Branch, the identification of anopheline mosquitoes caught in mail trains, on their arrival in Kuala Lumpur, was undertaken. A total number of 511 female and 187 male *Anopheles* was identified, distributed among thirteen species. The species included *A. maculatus and A. umbrosus* Theo.

During the investigations of the experimental rice plots the hydrogen ion concentration of a large number of waters was measured by means of Clark and Lubb's indicators and by means of a quinhydrone electrode. It was found that there was some discrepancy between the readings obtained by the two methods, and further investigations were made by Mr. B. A. R. Gater. These indicate that in natural, unbuffered waters the indicator method is not always reliable, and that in heated waters, for the determination of the so-called residual pH, there was a possibility of serious error amounting to over 1.0 pH.

## LEPROSY.

### Inoculation Experiments.

In the Report of this Institute for 1927, a series of experiments were reported that had been undertaken with a view to the elucidating of the mode of infection in leprosy. Attempts to infect monkeys (*M. cynomologus*) were made by (*a*) inoculation, (*b*) inhalation and (*c*) ingestion, with material from acute leprosy cases. Early in

1928 one of the monkeys developed dysenteric symptoms, and *B. dysenteriae* (Flexner) was isolated from its faeces. But, apart from this incident, all have remained well and none have shown any sign of leprotic infection. In the early months of this year the monkey, that had received an inoculation into the palm, was sacrificed. The autopsy was barren of any indication of infection and sections from the site of inoculation, the nerve trunks, lymphatic glands, liver, spleen, kidney, etc., all proved negative for *B. leprae*.

### Treatment with "Solganal."

A small series of eight lepers have been treated with "Solganal", the drug being kindly supplied by the manufacturers, Fabrik auf Actien (Von E. Schering), Berlin. Treatment was commenced by Dr. C. Russell Amies in 1928 and results with this small number of cases suggested that the preparation (a complex organic compound containing 36.5 per cent. of gold) had a beneficial effect on leprosy. Solganal appeared to have a further advantage in that it did not induce the leprous reaction, a fact which, if borne out by further experience, is of considerable importance. Vomiting and salivation were regarded as evidence of toxic action, indicating the advisability of a reduction in dosage. A full account of the series has been published elsewhere.

A survey of the eight cases at the end of this year showed that two had made no further progress, three had absconded, two had died and one had been placed on "Alepol" treatment.

### Treatment with "Lopion."

A supply of another gold preparation—"Lopion"—was received through the courtesy of the N. V. Straits Java Co., the local agents of the manufacturers. Twelve patients are being treated with the drug by Dr. H. M. Nevin.

It is of interest that complement fixation tests on these cases, employing an emulsion of *B. tuberculosis* as antigen, became definitely more positive as the treatment progressed. At the commencement only seven cases gave positive or partial positive reactions, but after from two to four months' treatment all twelve cases were positive though the Wassermann reaction remained negative.

### The Rubino Reaction in Leprosy.

From a long series of experiments relating to this reaction, it was concluded that the Rubino technique has many advantages over the ordinary erythrocyte sedimentation test. The reaction is not specific but a positive result may be of importance as an indication of probable infection, and results yield valuable information as to progress during treatment. The investigation has been reported in a paper by Dr. C. Russell Amies.

### Complement Fixation in Leprosy.

Experiments with a complement fixation test in leprotic infections have been undertaken with a view to the improvement of laboratory diagnosis of leprosy. An emulsion of *B. tuberculosis* was employed as antigen and the dose adjusted to 1/4 of the quantity which completely adsorbed 2½ m.h.d. of complement. Sera from 92 cases have been tested on admission to the Federal Leper Settlement, and positive or partial positive reactions were obtained in 60 instances.

### The Wassermann and Kahn Tests.

The Report for last year contained a brief note on the results of routine Wassermann and Kahn tests performed on inmates of the Federal Leper Settlement, Kuala Lumpur. These investigations were continued during the first-half of the year now under review.

Three hundred and sixty-two lepers were examined for both reactions during a period of fourteen months. Of these, 276 patients were Chinese, 82 were Tamils, and 4 were Javanese. All of these were afebrile when blood was taken, except those suffering from leprous reaction.

The results obtained are given in Table X. The classification adopted therein is considered more satisfactory than the older classification into anaesthetic, nodular, and mixed groups, for it affords some indication of the degree of tissue response on the part of the body to the invading organism.

Table X.

| Clinical type. | W.R. and Kahn Tests positive. | W.R. and Kahn Tests negative. | W.R. and Kahn Tests disagree. |
|---|---|---|---|
| 1. Pure nerve type: paralysis, deformities, trophic lesions, etc. | 47 | 123 | 10 |
| 2. Maculo-anaesthetic type— | | | |
| A. Active cases | 7 | 14 | 3 |
| B. Quiescent cases | 3 | 14 | 0 |
| 3. Nodular type— | | | |
| A. Small miliary nodules or papules | 2 | 5 | 1 |
| B. Thickened raised patches and scattered nodules: | | | |
| (i) Active | 2 | 7 | 5 |
| (ii) Quiescent | 2 | 6 | 2 |
| C. Many nodules, large thickened patches, leonine facies, etc.: | | | |
| (i) Active | 1 | 3 | 0 |
| (ii) Quiescent | 0 | 0 | 0 |
| 4. Mixed types— | | | |
| A. Mainly nerve type: | | | |
| (i) Active | 14 | 10 | 3 |
| (ii) Quiescent | 0 | 20 | 2 |
| B. Mainly cutaneous type: | | | |
| (i) Active | 23 | 20 | 6 |
| (ii) Quiescent | 2 | 4 | 1 |
| Totals | 103 | 226 | 33 |

It will be seen that 103, or 28.4 per cent. of the cases examined gave a positive reaction with both tests. Seventy-one, or 68 per cent. of these gave a definite history of previous venereal disease: the remainder denied any such history.

The information regarding those cases in which the two tests disagreed is given below:

Table XI.

| Serological test. | | Number of cases. | Clinical notes. |
|---|---|---|---|
| Kahn. | Wassermann. | | |
| Negative | + + | 1 | Leprous reaction. (W.R. negative two months later). |
| ,, | + | 1 | History of V.D. |
| ,, | ± | 6 | History of V.D. in 5. |
| ± | Negative | 10 | History of V.D. in 8. |
| + | ,, | 10 | History of V.D. in 8. |
| + + | ,, | 4 | Leprous reaction in 3: history of V.D. in 4th. |
| + + | ,, | 1 | History of V.D. |

## The Influence of Antisyphilitic Treatment.

A course of antisyphilitic treatment was given to 90 out of the 136 patients who gave a positive reaction to these tests. Stabilarsan was given intra-muscularly, commencing with 0.45 gm. and increasing to 0.60 gm. The average total amount administered was 4.59 gm., injections being given once a week.

At the end of this course of treatment, Wassermann and Kahn reactions were repeated. Fifty-six of 63 patients who had given a history of venereal disease, and whose sera had previously given positive reactions, were then found to have become negative or nearly negative.

Among the group of positive cases who had denied a history of venereal disease, 12 out of 27 cases became negative. It is reasonable to assume that syphilis was the actual cause of the positive reaction in these cases that improved under Stabilarsan treatment. Co-existing syphilis can thus be taken as the cause in 75 per cent. of these cases.

In the remaining 15 patients, who had denied a history of venereal disease, the serological results were unaltered by Stabilarsan treatment or, in a few cases, were actually rendered more strongly positive. These patients were either in an advanced stage of nodular leprosy, or were suffering from a more or less intense leprous reaction. It was found that antisyphilitic treatment in these cases was ineffective or definitely harmful, while in the syphilitic cases specific treatment determined a decided improvement in the general clinical condition.

### The Influence of the Leprous Reaction.

The series included 17 patients who, at the time when blood was taken, were suffering from a leprous reaction. Of these, 8 gave positive reactions with both tests, and the remaining 9 gave a reaction with one or other of the tests. Three of the latter who recovered from the reactive phase subsequently gave negative reactions to both tests, although they had received no antisyphilitic treatment.

It would therefore appear that the presence of a leprous reaction may cause non-specific reactions with Wassermann and Kahn tests. These investigations will be more fully reported by Dr. C. Russell Amies in a forthcoming publication.

## LEPTOSPIROSIS.

In the last report, reference was made to 7 cases of Leptospirosis that had been treated in the European Hospital, Kuala Lumpur, between the months of May and September. During the year under review, six cases have been admitted to the same hospital, one in April, three in May and two in June. All were European males, as were the cases in 1928.

Since 11 of the 13 European cases in Kuala Lumpur over the past two years, had been accustomed to bathe weekly in one or other of two popular swimming pools, an attempt was made by Dr. R. Lewthwaite to isolate the causal organism from the water of these pools. Samples were taken, some from the surface, others from the mud at the bed, others from shaded and almost stagnant recesses at the water's edge. These specimens were severally treated in various ways. Some portions were left raw, others were centrifuged at high speeds, others after centrifuging were passed through a Berkefeld filter. Subsequently a number of intra-peritoneal inoculations of guinea-pigs were made and cultivation was also attempted by sowing on autoclaved faeces. In every instance the results were negative.

The Ipoh Branch Laboratory reports that two cases (Europeans) of the disease occurred out of a party of seven who bathed in a swimming pool in the vicinity of Ipoh. These cases developed symptoms 4 and 11 days later respectively. They lived in different parts of the town and worked in different offices. The pool is fed by a small stream of water from the side of a hill. On the day of the bathing party, some mining coolies had previously bathed, and, contrary to the usual state of affairs, the water was unusually dirty as the muddy bottom had been stirred up. At a lower level and close to the bathing pool is another pond of muddy water, which is fed by the over-flow from the bathing pool. It is not used for bathing. Following these cases, isolation of *Leptospirae* from the pools was attempted. On the day of collection of the water the bathing pool itself had been emptied and the bed cleaned. There was thus only a small trickle of water flowing through the centre of the pool and out by the outlet drain. No *Leptospirae* was cultured from the bathing pool itself, but from the over-flow pool positive cultures were obtained. The organisms were, however, very few in number, and non-pathogenic to guinea-pigs.

It is worthy of note that, whereas the swimming pools near Kuala Lumpur, which gave negative cultures, have a running supply, the pool in the Ipoh district contains water which is much more stagnant.

A considerable number of cases have, in past years, been observed among agricultural and mining labourers who work in muddy soil and who often resort to bathing in muddy pools. Three fatal cases, two of them Chinese mining coolies, and one a Tamil, from the Kinta district, have come under observation during the year.

At autopsis on these cases, the following points were noted by Dr. K. Kanagarayer: Sub-pericardial and sub-pleural haemorrhages, with extensive lesions of the liver were seen in all three cases. Bleeding from the gums, sub-peritoneal haemorrhages, pin-point renal haemorrhages and marked congestion of the gastro-intestinal tract were occasional findings. A brief account of the morbid histology of these cases is given below:

*Case I* (*A male Tamil*).—Liver: All cells were in process of complete necrosis. Very little nuclear staining was visible, central and peripheral zones of the lobules being equally affected. There was absence of inflammatory reaction. The veins within Glisson's capsule showed dilation and there were deposits of blood pigment.

*Kidney*: Extensive disorganisation of the renal substance had occurred, the glomeruli, and, even more so, the tubules, showing acute necrosis. Nuclei failed to stain and the cytoplasm showed cloudy swelling and fatty change. The lumen of many of the tubules was plugged with bile. Inflammatory reaction was absent and deposits of blood pigment were seen.

*Case II* (*A male Chinese*).—Liver: The outstanding feature was extensive and recent haemorrhage into most of the lobules. Elsewhere, the inner and middle thirds of the lobule were destroyed but a zone of parenchyma, around the periphery, had escaped complete degeneration, though showing cloudy swelling. No normal liver tissue remained. In addition to the recent haemorrhages, blood pigment was diffusely distributed. Plasma cells, a few polymorphonuclears and an abnormally high proportion of eosinophils were seen throughout the liver tissue, but were numerous in the portal spaces. All branches of the portal vein were congested, and many were thrombosed. Diffuse extensive deposits of bile were noted, and there was an apparent proliferation of the smaller bile ducts.

Kidney: Congestion of the glomeruli and inter-tubular capillaries was seen. There was cloudy swelling of the tubal cells and scanty bile pigment within the lumen of many of the tubules.

Heart muscle: Sections showed extensive sub-pericardial congestion and extravasation. The vessels were congested and a few thrombosed. Muscle cells were bile-stained and showed degeneration and separation.

Lungs: There was extreme congestion with extensive blood and bile pigment deposition. Localised destruction of lung tissue had occurred, due to extensive extravasation of blood.

*Case III* (*A male Chinese*).—Liver: In this instance, cloudy swelling of the liver cells was of slight degree only. Congestion of the intra-lobar capillaries was not marked. On the other hand congestion of the central veins and branches of the portal veins within Glisson's capsule (with thrombosis of some of the latter) was present. Many liver cells contained considerable deposits of bile pigment. No leucocytic infiltration was seen.

Kidney: There was congestion of the capillaries; cloudy swelling and deposit of bile pigment were also noted in the cells of the tubules.

### Infection of Rats.

Kidneys of 16 rats, from the oil-palm estate on which tropical typhus is endemic, were cultured for *Leptosprae*, which were obtained in two instances.

## JAPANESE RIVER FEVER.

Two cases of this disease in European planters have come under observation. One lived on the coast of Negri Sembilan where his bungalow was surrounded by lallang and secondary growth. Trapping around the bungalow resulted in the catching of *Rattus c. concolor*, *Rattus r. diardi*, and *Rattus r. jalorensis*. The rats of the last species were found by Mr. B. A. R. Gater to be carrying *Trombicula deliensis* which is said to be the vector of Japanese river fever in the Dutch East Indies.

In this case the ulcer was situated over the right scapula. The course of the disease was severe, and, during convalescence, thrombosis of the veins of the right leg occurred. At about the time of onset, the wife also developed a small ulcer on her arm, similar in appearance to the primary lesion of Japanese river fever. Fever did not, however, supervene and it would appear possible that she may have been immune owing to a previous mild infection.

The second case was also severe. Such nervous manifestations as twitching of face and limbs were seen during the third week. Prostration was extreme and convalescence protracted. The patient was a young planter who frequently went shooting in swamps and jungle. He usually dressed in shorts and the ulcer was situated on the calf of the leg at the level of the top of the stocking.

Lice were fed on this second case of Japanese river fever by Dr. L. Anigstein and, in due course, *Rickettsia*-like bodies were found in the gut.

## ANAEMIA OF PREGNANCY.

In the later months of the year an investigation was begun into the occurrence of anaemia in pregnant women. Balfour and McSwiney have described a condition of pernicious anaemia of pregnancy that occurs in India amongst all communities, affects those who live in comparative comfort as well as the necessitous, is of short duration, and terminates fatally in some forty per cent. of cases; in the remainder rapid decline, prior to delivery, is followed by a progressive, and frequently rapid, improvement after parturition. In the series reported by these authors, approximately seventy per cent. of the infants were born dead.

Observations in the maternity wards of the General and District Hospitals, Kuala Lumpur, made it evident that a similar condition occurred in this country, although severe cases were by no means frequently encountered. With regard to communities, cases were seen amongst Tamils, Sikhs and Singalese. Malay and Chinese women very rarely seek admission to these hospitals for childbirth, and comprise none of these early cases.

In the months of October, November and December, nine cases were under the observation of Dr. R. Lewthwaite. Six were of the estate labourer class, but three were patients living in comfortable circumstances. Two only were primiparae; of the others, none gave a history of a similar condition in a previous pregnancy. In three cases delivery was premature. In two cases the child was still-born; in three, the child died within ten days or less.

All cases showed oedema of the feet in slight degree, and four cases puffiness of the face, these conditions being invariably described as having supervened during the last three months of pregnancy. Shortness of breath and prostration were marked features of two of the fatal cases. A haemic murmur was present over the pulmonary area of the heart in six cases. There was no icteric tinge of the conjunctive in any. Soreness of the tongue was present in one case only. Neither fever nor diarrhoea were noted. A history of previous dysentery was elicited in two cases; ankylostome ova were found in two cases, and ascaris ova in one. The Wassermann and Kahn tests were positive in two cases. The spleen was enlarged in one instance only. One patient had albuminuria, and that slight. Urinary culture yielded *B. coli* in two instances. From the faeces *B. welchii* was isolated in four instances. A non-haemolytic streptococcus was obtained from the margin of the gums in three out of five cases that had pyorrhoea alveolaris.

In reviewing the salient features of the blood picture it must be noted that all patients were first seen either within a period of two weeks before, or just after, delivery; hence at that time the intensity of the anaemia was more or less maximal. It is the experience of the two hospitals, in which these patients were seen, that pregnant women seek admission for their confinement only when this is immediately impending. Three patients sought admission on account of anaemia four weeks before term; and all three were delivered prematurely. The remainder were admitted at term.

On admission, the anaemia was marked; in one case the red cell count was two and a half millions; in five cases it lay between one and two millions; in the others it was less than one million, and in one fatal case was less than half a million. The white cell count showed no consistent variation, being raised in two cases, and diminished in two cases. The percentage haemoglobin varied between twenty-five and ten per cent. The colour index exceeded unity in three cases, in two it was unity, in two it was below 0.5. The differential white cell count showed a decrease in the usual polymorph to lymphocyte ratio; the average polymorph count being 55 per cent.; the average lymphocyte count, 40 per cent. Megaloblasts were seen once only; normoblasts were very few, and in one case absent; poikilocytosis and polychroma-tophilia were present, but only in slight degree. The reticulocyte count was low.

With regard to the van den Burgh reaction, the direct reaction was negative; the indirect reaction exceeded 0.5 units in two cases only, the readings in these being 0.8 units. It was possible to obtain estimations of the serum calcium before delivery in three cases only, so that no generalisation can be made thereon; the content was 8.34, 8.28 and 9.3 mgms. of calcium per 100 c.cms. serum, respectively, the blood having been drawn 15, 5 and 2 days before delivery in the respective cases. In a control series of eight pregnant women of the estate labourer class, none of whom had any of the symptoms of anaemia and in whom the average haemoglobin percentage was 45, the blood drawn variously during the seventh, eighth and ninth months of pregnancy (at term in five cases) showed an average calcium content of 8.4 mgms. per 100 c.cms. serum, the highest and lowest readings being 9.6 mgms. and 7.6 mgms. These estimations were undertaken by the Chemical Division.

The blood pressure was low, systolic readings being never higher than 120 mms. Hg., and the average reading 110 mms. The average diastolic reading was 73 mms.

Liver treatment was given to all nine patients when first seen, and their diet supplemented by additional eggs and fruit.

Three of the series died. The condition of two of them was desperate when admitted, anaemia, breathlessness, oedema and prostration being extreme; and death occurred within eight days and one day, respectively, of premature delivery. In the third fatal case death supervened from heart failure eleven days after delivery at term.

As noted previously, all the patients of this series were admitted only a few days prior to delivery, so that the effect of liver therapy before delivery could not be observed. After delivery, the five cases that survived the first few days of the puerperium showed progressive improvement (the sixth case insisted on her discharge from hospital on the seventh day after delivery). Since all had received liver treatment from admission, it is uncertain to what extent this recovery was spontaneous. Balfour and McSwiney, in their reports from India of cases of anaemia of pregnancy untreated by liver, both remark on the frequent rapid recovery that follows delivery, so that it is probable that liver therapy, at most, merely assisted a spontaneous recovery that, in five of these nine cases, began in the first few days of the puerperium, and continued throughout the period of observation, which was 2, 2, 4, 5 and 8 weeks respectively. The anaemia gradually decreased; in one case a red cell count of little more than one million on the fifth day of the puerperium had increased to two millions on the twenty-eighth day, to two and a half millions on the forty-first day, and to three and a half millions on the sixty-first day; in another case a count of one and a quarter millions on the fifth day of the puerperium had increased to one and three-quarter millions on the twentieth day, and to two and three-quarter millions on the thirty-fourth day; in another, a count of three-quarters of a million two weeks prior to delivery had fallen to less than half a million on the third day of the puerperium, but had risen to one million on the seventeenth day, and was two millions on the twenty-sixth day.

A progressive rise in the haemoglobin percentage also marked the puerperium; but was outrun by the erythrocyte increase, so that the colour index, where high before delivery, declined to reach limits of 0.5 to 0.7.

As an index of blood regeneration the variations in the recticulocyte count were interesting. Low before delivery in all cases, the count rose in one case from one per cent. on the day before delivery to nineteen per cent. on the day after delivery, and thereafter declined, being only three per cent. on the seventh day. In four other cases a similar abrupt and brief rise was noted, but was delayed until the fourth or fifth day.

## AMOEBIASIS.

### Treatment with "Rivanol."

An investigation of the therapeutic value of Rivanol (2-aethoxy-6.9-diamino-acridine lactate) in *E. histolytica* infections has been undertaken, the preparation "Rivanolettes" having kindly been supplied by Messrs. The N. V. Straits Java Co., the local agents for the I.G. Farbenindustrie Aktiengesellschaft. After preliminary saline treatment the drug was administered to a series of cases orally after food in a dosage of 2 pills t.d.s. (2 gr. daily) together with a daily enema of 10 ozs. of a dilution of 1/5000.

The following are brief extracts of some of the case reports:

*Case I.*—A male adult Tamil, of fair physique, had had dysenteric symptoms for a month previously. A ten-day course of Rivanolettes had no effect on the course of the disease. Emetine gr.i. was then given for ten days. Symptoms rapidly improved and from the fourth day onwards neither vegetative forms of amoebae nor erythrocytes could be found in the stools.

*Case II.*—A male adult Tamil, debilitated and anaemic, had had dysentric symptoms for three weeks before admission to hospital. He was given a course of Rivanolettes, but, as he showed little improvement up to the ninth day, emetine was substituted. The patient died four days later and, at the autopsy, the caecum and the whole of the colon were found riddled with sub-acute and chronic ulcers, in which numbers of the causal protozoon were found. There was little or no evidence of healing.

*Case III.*—A male adult Tamil of poor physique, with anaemia and some oedema, had had dysenteric symptoms for some seven months. On his admission to hospital he was given emetine for two days prior to a course of Rivanolettes. Dysenteric symptoms ceased after the fourth day of the latter treatment but, four days after the completion of the ten-day course, there was a relapse. A repeat course of Rivanolettes caused no improvement and it was necessary to revert to emetine, when amoebae disappeared rapidly from the stools.

From these and other case reports, and from the daily examinations of the stools, it would appear that the thereapeutic value of Rivanol in amoebic dysentery is negligible. These conclusions confirm the findings of Weitzman but are directly opposed to those of Wagner, Shaumann and Peter.

## BURNING FEET.

Burning feet is a condition which has been recognised in Malaya for many years past. It has been known to occur among Indian Hindus in Guiana for the past century (Sharples) and has also been recognised in India and West Africa.

During the period under review, sixteen cases have come under observation: twelve were on a rubber estate in Negri Sembilan; the others were seen in various parts of Selangor. All were Southern Indians, and, with one exception, all were labourers on rubber plantations. The exception was employed as a clerk. Age varied from 18 to 45 years and the series comprises nine males and seven females. One had been in Malaya no longer than a month, another had worked here for 16 years. One case was seen ten days after the onset of acute symptoms but a few had had recurrent attacks over the previous two or three years.

Patients complained of severe burning of the feet usually limited to the soles, but occasionally also involving the lower part of the legs. In some instances the pain was definitely worse in the morning and was always intensified by walking. Cases were frequently unable to work for long periods and the severity of the pain was evident from the fact that adult male patients were sometimes seen crying in hospital. Rarely these cases also complained of slight headache (2 cases) and dimness of vision (1 case). There was sometimes a history of antecedent formication.

The soles of the feet showed no constant lesion. Excoriations were commonly seen. Ringworm infection of the skin and nails was frequent. A few pigmented spots were seen in three of the cases. On examination, tenderness of the calves was elicited in three instances; in two more this tenderness was slight. Knee jerks were exaggerated in two cases, brisk in five others and absent in none. In five instances a tremor of the tongue was noted. Dental sepsis, with some gingival hypertrophy, was present in seven cases but such sepsis is by no means uncommon among the Indian labourers. There was no adenitis or haemorrhages. In one case an enlarged spleen confirmed a malarial history. The pulse was rapid and the first heart sound poor in five instances. A systolic mitral murmur (1 case) and a murmur in the region of the pulmonary valve (1 case) were heard.

Haematological examination of the cases yielded variable results. Erythrocytes varied from 2½ to 6 millions per c.mm. while haemoglobin ranged from 45 to 75 per cent. The leucocytes varied from 3,500 to 11,500 per c.mm. and, as a rule, lymphocytes and eosinophils were both relatively increased. In the majority of cases there was a shift of the Arneth index to the right. Biochemical estimations were undertaken by Mr. R. W. Blair. Serum calcium ranged between 8.1 and 10.3 mgs.

per 100 c.cms. of serum. Cholesterol varied between 32 and 66 mgs., except in three cases with 110,200 and 200 mgs. respectively, and phosphates ranged from 4.9 to 8.1 mgs. Fouchet's test indicated the presence of bile in the serum of three cases, of which one had a malarial history and an enlarged spleen.

The Wassermann was consistently negative but the Kahn reaction was positive in three cases. Syphilitic infection can therefore have no bearing on the etiology of the condition which is regarded as a deficiency disease. Malarial and helminth infections are thought to play little part in causation. The course is sometimes a long one but improvement would seem to occur on a liberal mixed diet of fresh food. Labourers believe that improvement and cure are hastened by return to their Indian homes, but, in one case of this series, symptoms had appeared before embarkation for this country.

## YAWS.

### Treatment by "Halarsol."

A supply of "Halarsol" was received from Messrs. May and Baker through the Hon'ble the Principal Medical Officer, the preparation (3—hydroxy—4 amino-phenyl-dichlorarsine) being in ampoules, each containing 2.0 c.cms. of a 2.5 per cent. solution. Claims of the efficiency of the compound in the treatment of yaws have been made from the Belgian Congo and the manufacturers forwarded a batch of 100 ampoules for trial in this country.

Early yaws is now rarely seen in Selangor owing to the "yaws campaigns" of former years, but, thanks to the courtesy of Dr. H. G. Holdbrook, Senior Medical Officer for the State, cases of the disease were made available for the trial treatment at Beranang, Klang and Ijok. Periodic visits were paid to these centres where cases from among the surrounding population collected at a definite time. When lesions were healing the majority ceased to attend and it was only by considerable persuasion that seventeen persons completed a course of four injections.

As the result of previous campaigns, only three early cases were seen during the investigation. The remainder of the forty cases that came under observation showed tertiary lesions, of which "crab yaws" was the most common. Juxta-articular nodules were seen in four cases and it is of interest that these fibrotic tumours tended to retrogress during the period of treatment with arsenical derivatives. Injections were made weekly, except when public holidays supervened, and specimens of blood were taken before each injection for quantitative Wassermann and Kahn tests. Clinical notes and serological results were obtained from nineteen cases treated with "Halarsol" and of seven control cases treated with Novarsenobillon.

From clinical observation it appeared that "Halarsol" was the more effective therapeutic agent. The manufacturers claim, however, that the preparation can be employed intra-venously, intra-muscularly or sub-cutaneously. No ill effects were seen after any of the intra-venous injections but the intra-muscular route was used on four occasions and extensive tense swellings with considerable pain resulted. Resolution took place after an interval of a week to ten days.

The usual quantitative Kahn test was undertaken on all blood specimens. Quantitative Wassermann reactions were done by Harrison's technique but employing 2½ m.h.d. of complement only. Tests were carried out in a series of tubes employing 1/1, ½, ¼, ⅛, 1/16 and 1/32 of the usual quantity of serum, and, for convenience in reading, these tubes were numbered 1 to 6, respectively. The end point of the reaction was taken as the last tube in which haemolysis was incomplete.

The effect of "Halarsol" and of N.A.B. on the Wassermann reaction is shown in Table No. XII, which indicates the movement of the end point as the result of treatment. Here again, in the dosage employed, results with "Halarsol" were rather better than with N.A.B.

One important finding emerges from these results—that in more than half the tertiary cases the Wassermann reaction was positive with 1/16 to 1/32 of the quantity of serum employed in the standard routine Wassermann test, and in only about 10 per cent. of this series, did the test become negative after one, two and three injections. These results are similar to those obtained with N.A.B. by Dr. G. V. Allen in Kenya. It cannot be expected, therefore, that one or two injections of an arsenical preparation will result in "serological" cure and immunity from further lesions.

### TABLE No. XII.

Shewing Change in the End Point of the Quantitative Wassermann Reaction due to Treatment by "Halarsol" and by N.A.B.

| No. of Injections before final Specimen. | Halarsol. (Dosage 2.0 c.cms.) | | | N.A.B. Controls. (Dosage 0.3 followed by 0.45 grammes.) | | |
|---|---|---|---|---|---|---|
| | Case No. | Change in end point (Tube Nos.) | Interval (days.) | Case No. | Change in end point (Tube Nos.) | Interval (days.) |
| 1 | V | 6th to 5th | 12 | — | — | — |
| | XIV | 6th to 4th | 21 | — | — | — |
| | I | 3rd to 1st | 26 | — | — | — |
| | VI | 3rd to 0 | 12 | — | — | — |
| 2 | XV | 5th to 4th | 21 | (17) | 4th to 4th | 26 |
| | (3) | 5th to 4th | 26 | (21) | 3rd to 4th | 14 |
| | (4) | 4th to 3rd | 33 | — | — | — |
| 3 | I | 6th to 5th | 36 | — | — | — |
| | (6) | 6th to 3rd | 26 | (19) | 6th to 6th | 26 |
| | | | | (10) | 5th to 5th | 40 |
| | (20) | 5th to 5th | 26 | (9) | 5th to 3rd | 26 |
| | XIII | 5th to 4th | 35 | (18) | 4th to 3rd | 26 |
| | (12) | 6th to 4th | 40 | — | — | — |
| | (2) | 5th to 3rd | 26 | — | — | — |
| | (7) | 5th to 3rd | 26 | (11) | 3rd to 0 | 26 |
| | (15) | 5th to 3rd | 26 | — | — | — |
| | (14) | 4th to 2nd | 26 | — | — | — |
| | (17) | 4th to 2nd | 26 | — | — | — |
| | VII | 4th to 0 | 21 | — | — | — |
| | III | 3rd to 2nd | 13 | — | — | — |

## THE TYPING OF PNEUMOCOCCI.

From time to time, cases of pneumonia occur among Indian labourers when on the voyage to this country or during sojourn in quarantine, and, it has been suggested by Dr. A. K. Cosgrave that, the use of a prophylactic vaccine, prior to embarkation, might serve to reduce the incidence of the disease. An investigation of local pneumococci was commenced in the later months of the year, strains being obtained from cases of lobar and bronchial pneumonia, gingivitis, peritonitis and other morbid conditions. Biochemical reactions are being worked out and typing is also being undertaken. Dr. F. Griffiths of the Ministry of Health, London, kindly supplied sera for Nos. I, II, L. 41, B. 55, Pn. 288 and Pn. 292 of his types and IV, V, VI, VII, IX, X, XI, XII and XIII of Miss G. Cooper's American types.

Agglutination tests with 16 strains had been undertaken up to the end of the year. Two strains reacted with B. 55 serum, 1 with IV, 2 with VI, 1 with VII, 2 with X, and 1 with XIII. Seven strains failed to react with any of these sera, but six of them were agglutinated by a serum prepared at this Institute from one of the strains. The work is handicapped by lack of laboratory mice.

## EPIDEMIC DROPSY.

A small familial outbreak of dropsy, observed by Dr. K. Kanagarayer in Ipoh, is recorded under the above heading because the clinical picture was rather similar to that described for epidemic dropsy from Bengal and elsewhere. The patients included two Bengalis (husband and wife) and their Tamil cook.

The wife was the first case. Early symptoms were loss of appetite, giddiness and epigastric pain, followed, a fortnight later, by palpitation, dyspnoea and oedema of feet and legs. Later, areas of erythema developed on the oedematous parts. She came under observation six months after the onset, when the skin was wrinkled over the sites of previous oedema and areas of erythema still persisted. Knee jerks were normal and the haemoglobin was 45 per cent.

Some ten days after the commencement of the wife's illness, the husband complained of gastric pain, so acute, that X-Ray examination was undertaken to exclude the possibility of a gastric ulcer. Three days afterwards, giddiness, breathlessness and oedema supervened. For the next five months, occasional periods of sick leave were necessary on account of exacerbations of palpitation and weakness. From time to time there appeared areas of erythema on the limbs and ecchymoses on the trunk. When examined, all reflexes were normal; calf muscles showed no tenderness or wasting; the heart was slightly dilated; the pulse rate rapid, and markedly increased on slight exertion. The systolic blood pressure was 124; the diastolic 72 mm. Hg. Haemoglobin was 65 per cent., erythrocytes 4,400,000 and leucocytes 9,050 per c.mm. Wassermann and Kahn reactions were negative.

The cook became ill about ten days after the husband, but complained of slight epigastric discomfort and oedema only. It is noteworthy that the gastric symptoms were followed by circulatory and cutaneous disturbances in all three cases.

On enquiry it was found that the diets were similar to those of the majority of Asiatics—carbo-hydrates formed a large part and the protein intake was low. Their rice had come from the Government rice-mills and no deficiency in vitamin supply could be established. The history and clinical features seemed to point to an intoxication, and Dr. Kanagarayer suggested that a supply of mustard oil, obtained in bulk some days before the onset of symptoms, may have been the cause. Much more of this oil was taken by the husband and wife than by the cook.

## "SAWAH" ITCH.

Further investigation of "sawah" itch which is prevalent in the Tampin district of Negri Sembilan has yielded interesting results (Dr. C. Russell Amies). Local Malays ascribed this condition to certain snails which had appeared in the rice fields. Several species of *Cercariae* have been obtained from the snails, of which many have been identified, but attempts in the laboratory to cause dermatitis by the exposure of the skin to attack by the *Cercariae* have been attended with negative results.

## VACCINE LYMPH PRODUCTION.

In June last, Dr. P. H. Martin visited Bandoeng where, by the courtesy of Dr. Lonkhuyzen, Director of the Netherlands-Indian Civil Medical Service, and of Dr. Otten, the Director of the Institute, he was shown all stages of vaccine lymph production.

The methods employed in the Dutch Indies have been adopted by him for this Institute and seed lymph from a buffalo was kindly supplied by Dr. Otten. The final product, when issued, will conform with the Therapeutic Substances Regulations (London) 1927, Second Schedule Part 1 (B) as regards potency and bacterial content.

Buffalo lymph is employed for human vaccination, buffaloes being inoculated with calf lymph which, when necessary, is rejuvenated by passage through rabbits. Up to the present, Indian buffaloes of about two years have been employed for production, while locally bred calves of about one year, and local white rabbits have been used for seed lymph. Potency tests have been carried out on both white rabbits and Belgian hares.

Buildings: An old animal house in the Institute compound has been reconstructed as a stable. It contains ten stalls, four of which have been fitted with slinging trestles, in order that the procedure used in Java may be followed exactly. The stables are well ventilated, and so arranged and tiled that they can be easily cleaned. An operating room for vaccination and scraping has been built to connect with the stables by a short covered way.

Quarantine: A grazing ground with animal houses has been constructed about a mile distant from the laboratories. It is sub-divided into three sections, each of which is isolated by a double fence of barbed wire. The Veterinary Surgeon, Selangor, has kindly made all arrangements for purchasing calves and buffaloes, and has also inspected all animals before they have been subjected to vaccination.

Vaccination: Calf and buffalo. The technique follows exactly that used in Java. The abdomen and right flank are used for scarification, no antiseptic being used in the cleansing process. The vaccinated area is kept covered with a sterilised cloth and apron. The animal remains in the stall for the four days before scraping, and is prevented by padded slings from lying down and soiling itself.

Collection of pulp: On the operating table the vaccinated area is cleansed, no antiseptics being used. The animal is stunned with a Cash captive bolt pistol, and bled. Pulp is scraped with a Volkmann spoon and when this process is completed, a post-mortem examination is carried out.

Preparation of lymph: The pulp is ground with double the number of c.cms. of sterile neutral 80 per cent. glycerine as the pulp weighs in grammes. The resulting "undiluted" lymph is repeatedly exhausted in a vacuum chamber to remove as much air as possible.

Storage: The "undiluted" lymph is stored in the cold. Up to the end of 1929, the storage plant, which is to maintain a temperature of about 0°F., had not been received, but completion of the installation is expected in January.

Tubing: The lymph will be diluted and tubed at the latest time possible before issue.

Tests: Bacteriological tests are undertaken—

(*a*) when the "undiluted" lymph is first made;

(*b*) after a week at room temperature, and again at intervals until the count has fallen below 5,000 organisms per c.cm. This short storage of "undiluted" lymph at room temperature is the method employed of obtaining a satisfactory bacterial content;

(*c*) during cold storage; e.g., before tubing.

Potency tests: Of the four possible tests, described in the 1928 Report of the Committee on Vaccination appointed by the Ministry of Health in conjunction with the Medical Research Council, pages 25 and 26, Groth's & Sobernheim's are used. Potency is first estimated as soon as the bacterial count is satisfactory, and again, shortly before tubing, in order to estimate the degree of dilution possible.

Dilution: It is hoped that the potency of lymph, when issued, will be such that positive tests will be obtained at a dilution of 1/1000 but negative tests with dilutions greater than 1/4000.

Infant vaccination: After bacteriological and potency tests have been satisfied, each batch of lymph will be further proven before issue by vaccination of children at the Infant Welfare Centre, Kuala Lumpur. Mrs. M. J. Were, the Lady Medical Officer, has kindly consented to co-operate for this test.

During the last six weeks of 1929, four calves and two buffaloes have been vaccinated. Yields have been small compared with those obtained in Java, particularly in the case of calves. Local calves yielded 6, 19, 24 and 35 grammes of pulp respectively, the buffaloes 160 and 110 grammes. No human vaccination has yet been made with local lymph.

## CANINE ANTI-RABIES VACCINATION.

In an attempt to reduce the incidence of rabies in the State of Selangor, and, at the same time, further to assess the efficacy of prophylactic inoculation of dogs in this country, the Veterinary Surgeon, Selangor, in conjunction with this Institute (Dr. R. Lewthwaite) is embarking on a campaign of mass inoculation of as many dogs as possible in the Kuala Lumpur Sanitary Board area. Similar projects have been carried out with marked success in certain districts in Japan and America. In the former, 31,000 dogs were inoculated, of which only one subsequently developed rabies. The sequel was a reduction of the number of cases of rabies amongst dogs by 75 per cent. with a corresponding decrease in the number of bites. A report on a similar campaign carried out in Germany was, however, less favourable.

Such an undertaking in this country is beset with many difficulties, the chief of which are the large number of ownerless, and therefore unlicensed, dogs; and the ignorance of the poorer classes, especially in the more remote districts. As a preliminary, the sanction of the Hon'ble the British Resident, Selangor, was obtained to make prophylactic inoculation a condition of the granting of a licence. The cost of the campaign is being born conjointly by the Institute and by the medical vote for the State.

The Veterinary Authorities estimated that between 3,000 and 4,000 dogs would require inoculation; it was therefore necessary to prepare some 25,000 c.cms. antirabic vaccine. The method used was that previously employed here, namely, that of Umeno, Vet, and Doi, with one modification; whereas these authors used rabbits as passage animals, here young buffaloes were used, with consequent economy of time and expense. No difficulty was anticipated or experienced. After anaesthetisation the buffalo was inoculated intra-cerebrally with passage virus; symptoms of paralytic rabies developed six days later, were marked on the seventh day, and the animal was killed by chloroform inhalation when death impended. Each brain was found to weigh between 450 and 500 gms.; and the spinal cord some 60 to 70 gms. The number of doses (6 c.cms.) of vaccine obtained from one brain and cord lay between 250 and 300.

The vaccine, when ready for use, was issued to the Veterinary Authorities, who, in co-operation with the Police, are organising two inoculation centres and the registration and recording involved.

## EXTRACT OF RICE POLISHINGS.

The preparation of the liquid extract of rice polishings was carried on throughout the year, and a sufficient supply was available to meet the demands from within the Federated Malay States. Several inquiries were received from outside sources regarding the supply of extract but it has been found necessary to postpone action in these cases pending the completion of the new plant.

Twenty thousand, five hundred and thirteen fluid ounces of the liquid extract were prepared during the year 1929, and twenty-two thousand, three hundred and thirty-three fluid ounces were issued.

In February, Dr. I. A. Simpson visited the Geneeskundig Laboratorium, Weltevreden, Java, and, through the courtesy of the Director, he was given every opportunity of studying the methods adopted for the production of activated acid clay material on a large scale, based on the method worked out by Drs. Jansen and Donath. As a result of this visit, it was decided to prepare a similar product at this Institute and the necessary apparatus was ordered from England. Towards the end of the year, the plant was assembled and it is expected that production will commence in January next. The capacity will be at least five times that of the older plant, and the finished product will be issued either loose, in powder form, or made up as tablets.

This preparation is not recommended in cases of infantile beri-beri: it is intended to prepare a further concentrate in the form of a syrup, for use in such cases.

Tests carried out on cocks and other birds have shown that the solid form of extract is a prophylactic against avian polyneuritis, but it has not yet been possible to study its effect on cases of beri-beri. It is hoped that opportunity for suitable tests on human cases will be obtained during the year 1930. Until the results of such direct tests are available, batches of the material will be tested on suitable birds, prior to distribution.

## COLIFORM ORGANISMS FROM LOCAL WATERS.

Dr. J. E. Lesslar has continued his investigation of the organisms occurring in local water supplies. During the year, 751 colonies have been isolated and tested for their biochemical reactions. Identification has been attempted from Bergey's Determinative Bacteriology.

The following organisms have been isolated, the numbers referring to the times that each was found:

| | |
|---|---|
| *Achromobacter metalcaligines* | 4 |
| ,, *liquefaciens* | 6 |
| ,, *gasoformans* | 6 |
| ,, *visco-symbioticum* | 5 |
| ,, *connii* | 7 |
| ,, *pinnatum* | 5 |
| ,, *punctatum* | 2 |
| *Aerobacter aerogenes* | 19 |
| ,, *cloacae* | 50 |
| ,, *oxytocum* | 3 |
| *Chromobacterium violaceum* | 35 |
| *Pseudomonas aeruginosa* | 16 |
| *Proteus asiaticus* | 13 |

| | |
|---|---|
| *Serratia marcescens* | 3 |
| ,, *rubefaciens* | 2 |
| ,, *lactica* | 2 |
| *B. enteritidis sporogenes* | 50 |
| *E. neapolitanis* | 94 |
| *E. communior* | 46 |
| *E. communis* | 18 |
| *E. acidi lactici* | 15 |
| *E. coscoroba* | 26 |
| *E. vesiculosis* | 20 |
| *E. pseudocoloides* | 29 |
| *E. grunthali* | 56 |
| *E. schaefferi* | 6 |
| *B. pneumoniae (Friedlander)* | 1 |
| *B. faecalis alcaligenes* | 5 |
| *B. simplex* | 1 |
| *B. 71 (MacConkey)* | 7 |
| *B. 102 (MacConkey)* | 42 |
| *Actinomyces nigra* | 3 |
| Not identified | 154 |

According to MacConkey's grouping, there have been 227 (32 per cent.) in Group I, 46 (6.5 per cent.) in Group II, 158 (22 per cent.) in Group III and 282 (39.5 per cent.) in Group IV. These percentages are approximate to those given by Dr. P. S. Hunter in the Annual Report of the Health Department, Municipality of Singapore, 1928.

## IV.—ROUTINE.

### DIVISION OF BACTERIOLOGY.

(Dr. P. H. Martin, Acting.)

### The Weil-Felix Reaction.

This has been carried out on all specimens submitted for the Widal reaction and some 3,200 sera have been tested with both "K" and "W" strains of *Proteus X 19*. Since August most human sera that agglutinated with either the "K" or "W" strain have also been further tested with "H" and "O" strains from the State Institute of Hygiene, Warsaw. Reactions with these four strains have also been carried out with over 400 sera from experimental animals.

The emulsions of *Proteus X 19*. "K" and "W" strains for the Weil-Felix reaction, have been prepared by Bien's alcoholizing method; the "H" and "O" emulsions from boiled broth cultures. Dreyer's technique has been employed, incubating at 55°C. for 5 hours, with a second reading after a further 21 hours at ice chest temperature.

### Widal Reactions.

Wright's technique was employed up to 18th January, but from that date Dreyer's method has been substituted. The change required a larger quantity of serum (0.5 c.cms.) from each patient, and a circular letter was accordingly issued. In such cases where the larger quantity of blood is difficult to obtain, specimens received in capillary tubes are still tested by the capillary tube technique.

When positive results have been obtained with the "large flaking" formalised broth emulsions, sera have been again tested with emulsions of bacilli from smooth colonies treated by Bien's method—an investigation instituted by Dr. G. V. Allen. In three proved cases the titre with the "small flaking" emulsion varied between 1/50 and 1/500, while the "large flaking" agglutination titre was much higher. One case, in which the causal organism was not isolated, gave a "small flaking" titre higher than the "large flaking" titre (1/2500). Absence of "small flaking" agglutinins (in dilution of 1/25 and higher), in a case of pyrexia of unknown origin in an inoculated European, with a "large flaking" titre rising from 1/500 and 1/1000, helped to negative a possible diagnosis of enteric fever. No enteric organism could be isolated from the excreta, and the clinical course was unlike that of an enteric infection.

### Melioidosis.

*B. whitmori* was isolated seven times during the year, in each case from post-mortem material. Six cases came from the Kuala Lumpur hospitals.

### Meningitis.

Meningococci were reported in 55 specimens of cerebro-spinal fluids, 30 cases being from Port Swettenham Quarantine Camp. A serum prepared from one of the strains failed to agglutinate two other strains, isolated about the same time. The therapeutic serum, which was available, showed very slight agglutination in low titre with these strains and complement fixation tests were negative. Later in the year a supply of therapeutic serum was obtained from Java, which contained considerable agglutinins for the locally isolated strains.

### Prophylactic Vaccines.

| | Quantity prepared. | Stock Dec. 31st, 1929. |
|---|---|---|
| Cholera vaccine | — | 73,600 c.cms. |
| Plague vaccine | 5,000 c.cms. | 7,600 ,, |
| "T.A.B.C." vaccine | 2,100 ,, | 1,700 ,, |
| Anthrax vaccine No. I | 3,700 ,, | — |
| ,, ,, No. II | 3,400 ,, | — |

*Cholera Vaccine.*—A strain of *V. cholerae* received from the Central Research Institute, Kasauli, and another, isolated in the Federated Malay States in 1927, are grown in rectangular bottles on alkaline agar, enriched with pea flour. When growth has proceeded for 48 hours it is washed off with carbol-saline, heated to 60°C. and standardized, by the opacity method, to a strength of 1 mgm. per c.cmm. The recommended dosage is 1.0 c.cm. for a single administration, or, if two doses are given, 0.5 c.cms. followed at a week's interval by 1.0 c.cm.

*Plague Vaccine.*—This vaccine will be prepared from tested sub-cultures from the heart blood of an infected rat, as described in the report of the Bombay Bacteriological Laboratory for 1924. Tests for purity will be undertaken according to the report of the Haffine Institute for 1928. Standardisation will follow the technique for estimation of bacillary growth and toxicity advocated by de Schmidt.

*T.A.B.C. Vaccine.*—The "C" of this vaccine is a *B. Paratyphosus C.* The vaccine is prepared from smooth colonies of mixed strains.

*Anthrax Vaccine.*—Through the courtesy of Dr. R. Gautier, Director, League of Nations Health Organisation, Eastern Bureau, attenuated cultures of No. I and No. II vaccines were received from Dr. Otten of Bandoeng, Java. From these strains vaccines were prepared for, and used by, the Veterinary Authorities of Kelantan. The Chief Medical Officer, Kelantan, reported that 494 cattle and buffaloes had been vaccinated. With No. I vaccine the general reaction was negligible, and the local reaction very slight. Twenty animals were reported unfit for work for 3 or 4 days, while 6 animals, including 2 calves, died within a month of receiving the second vaccine. In one fatal case anthrax was suspected to be the primary cause of death.

### Schedule of Examinations.

*(Including specimens undertaken by the Branch Laboratory, Ipoh, from August to December.)*

| | |
|---|---|
| Amoebiasis— | |
| Faeces: | |
| *E. histolytica* | 7 |
| Cholera— | |
| Eleven cases of faeces were received all negative. | |
| Cystitis— | |
| Bacteriological examination of urine: | |
| *B. coli* | 47 |
| *Eberth. ambigua* (Bergey) | 2 |
| *B. morgani* | 1 |
| Negative | 82 |
| | 132 |

Diphtheria—

Throat swabs:

| | |
|---|---|
| Positive cultures | 185 |
| Negative cultures | 1,220 |
| | 1,405 |

The distribution of the diphtheria cases was as follows:

| | |
|---|---|
| Selangor— | |
| Kuala Lumpur | 80 |
| Klang | 5 |
| Kajang | 1 |
| Perak— | |
| Taiping | 11 |
| Ipoh | 47 |
| Kuala Kangsar | 1 |
| Telok Anson | 1 |
| Tapah | 1 |
| Negri Sembilan— | |
| Seremban | 13 |
| Kuala Pilah | 1 |
| Tampin | 13 |
| Pahang— | |
| Bentong | 2 |
| Raub | 2 |

Dysentery (bacillary)—

Faeces:

| | |
|---|---|
| *B. dysenteriae* Shiga | 1 |
| *B. dysenteriae* Flexner | 16 |
| Negative | 106 |
| | 123 |

Enteric fevers—

(*a*) Widal Reactions:

| | |
|---|---|
| Total number performed | 2,404 |
| *B. typhosus* positive | 247 |
| *B. paratyphosus A* positive | 51 |
| *B. paratyphosus B* positive | 35 |
| *B. paratyphosus C* positive | 12 |
| Negative | 2,059 |

(*b*) Bacteriological examination of faeces:

| | |
|---|---|
| *B. typhosus* isolated. (Autopsy 4) | 17 |
| *B. paratyphous C* isolated | 1 |
| Negative | 359 |

(*c*) Blood culture:

| | |
|---|---|
| *B. typhosus* isolated | 1 |
| *B. paratyphosus A* isolated | 3 |
| Negative | 55 |

(*d*) Bacteriological examination of urine:

| | |
|---|---|
| *B. typhosus* isolated | 5 |
| *B. paratyphosus A* isolated | 1 |
| Negative | 344 |

| | |
|---|---|
| (*e*) *B. typhosus* isolated in almost pure culture from pleural fluid | 1 |
| (*f*) *B. typhosus* isolated from c.s.fluid | 1 |

Hospital distribution of cases:

| | |
|---|---|
| Perak— | |
| Tanjong Malim | 1 |
| Parit Buntar | 2 |
| Kuala Kangsar | 49 |
| Telok Anson | 14 |
| Ipoh | 19 |
| Taiping | 22 |
| Batu Gajah | 10 |
| Bagan Serai | 4 |
| Tapah | 3 |
| | 124 |
| Selangor— | |
| Kuala Lumpur | 67 |
| Klang | 11 |
| Kajang | 3 |
| Kuala Kubu | 3 |
| Serendah | 5 |
| | 89 |
| Negri Sembilan— | |
| Port Dickson | 2 |
| Seremban | 13 |
| Tampin | 1 |
| Kuala Pilah | 2 |
| | 18 |
| Pahang— | |
| Kuala Lipis | 14 |
| Mentakab | 1 |
| Bentong | 4 |
| Kuantan | 4 |
| Raub | 7 |
| | 30 |
| Kedah— | |
| Perlis | 2 |
| Kulim | 6 |
| Sungei Patani | 1 |
| Alor Star | 3 |
| | 12 |
| Kelantan | 1 |

Gonorrhoea—

| | |
|---|---|
| Urethral smears: | |
| Positive | 6 |
| Negative | 33 |
| Vaginal smears: | |
| Positive | 1 |
| Negative | 4 |

Syphilis—

*T. pallidum*:

| | |
|---|---|
| Positive | 2 |
| Negative | 13 |

Leprosy—

Smears from nodules:

| | |
|---|---|
| Positive | 10 |
| Negative | 8 |

Nasal smears:

| | |
|---|---|
| Positive | 4 |
| Negative | 15 |

Leptospirosis—

Blood culture:

| | |
|---|---|
| Positive | 6 |
| Negative | 10 |

Dark ground examination of urine:

| | |
|---|---|
| Positive | 5 |
| Negative | 56 |

Meningitis—

Cerebro-spinal fluid:

| | |
|---|---|
| Meningococci | 55 |
| Pneumococci | 8 |
| Streptococci | 1 |
| *B. tuberculosis* | 3 |
| *B. influenzae* | 1 |
| Negative | 96 |

Naso-pharyngeal cultures for Meningococci:

| | |
|---|---|
| Positive | 2 |
| Negative | 215 |

West swabs to the number of 206 were received through the following:

| | |
|---|---|
| H.O., Kuala Lumpur | 48 |
| H.O., Selangor East | 99 |
| H.O., Kuala Kangsar | 42 |
| H.O., Selangor Coast (Port Swettenham Camp) | 17 |
| | 206 |

Plague—

Human (gland):

| | |
|---|---|
| Positive | 0 |
| Negative | 2 |

Tuberculosis—

Sputum:

| | |
|---|---|
| Positive | 4 |
| Negative | 26 |

Guinea-pig inoculated with sputum:

| | |
|---|---|
| Positive | 5 |
| Negative | 3 |

Guinea-pig inoculated with urine:

| | |
|---|---|
| Positive | 1 |
| Negative | 4 |

Pus and body fluids:

| | |
|---|---|
| Positive | 1 |
| Negative | 5 |

Tropical Typhus—

Serums of 159 cases gave a positive Weil-Felix reaction during the year against 83 cases of 1928. One hundred and seven of these agglutinated *Proteus X 19* "K" strain and 52 agglutinated *Proteus X 19* "W" strain, as compared with 72 and 11 respectively of 1928.

"K" strain: Sixty-eight were cases from the oil-palm estate, as compared with 44 of the previous year. The remainder came from the following hospitals:

| | |
|---|---|
| Selangor— | |
| Kuala Lumpur | 10 |
| Klang | 1 |
| Kajang | 4 |
| Kuala Kubu | 1 |
| Serendah | 1 |
| Perak— | |
| Kuala Kangsar | 3 |
| Ipoh | 1 |
| Batu Gajah | 1 |
| Teluk Anson | 1 |
| Negri Sembilan— | |
| Tampin | 1 |
| Seremban | 1 |
| Kuala Pilah | 1 |
| Pahang— | |
| Kuala Lipis | 6 |
| Raub | 4 |
| Mentakab | 2 |
| Bentong | 1 |

The 52 cases agglutinating the "W" strain came from the following hospitals:

| | |
|---|---|
| Selangor— | |
| Kuala Lumpur | 20 |
| Kuala Kubu | 1 |
| Klang | 2 |
| Perak— | |
| Ipoh | 4 |
| Batu Gajah | 6 |
| Telok Anson | 3 |
| Kuala Kangsar | 6 |
| Tapah | 1 |
| Taiping | 1 |
| Negri Sembilan— | |
| Seremban | 1 |
| Kuala Pilah | 1 |
| Labu | 1 |
| Pahang— | |
| Kuala Lipis | 1 |
| Kedah— | |
| Kulim | 2 |
| Alor Star | 2 |

| | |
|---|---|
| Weil-Felix Reactions— | |
| Total number performed | 3,234 |
| Positive * | 423 |
| Negative | 2,811 |
| Vaccines (autogenous)— | |
| Number prepared | 128 |

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* For number of positive cases, *see* above.

## Water.

Samples were received from the following sources, the number examined being 315 against 84 of the last nine months of 1928.

### TABLE XIII.

| Source. | No. of samples received during the year. | Average number of bacteria per c.cm. on ordinary agar at 37°C. after 48 hours. | Average number of bacteria per c.cm. on MacConkey's lactose peptose bile salt agar after 48 hours. | Lactose Fermenters. | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Not detected in 10 c.cms. | Detected in | | | |
| | | | | | 10 c.cms. | 5 c.cms. | 1 c.cm. | 0.1 c.cms. |
| **SELANGOR.** | | | | | | | | |
| *Kuala Lumpur Water Supply, Kuala Sleh, from 16th September, 1929.* | | | | | | | | |
| Testing Filter Beds— | | | | | | | | |
| Raw water ... ... ... ... | 14 | 351 | 64 | 0 | 0 | 0 | 2 | 12 |
| Filtered water— | | | | | | | | |
| No. 1 Filter bed ... ... ... | 1 | 79 | 5 | 0 | 1 | 0 | 0 | 0 |
| No. 2 ,, ... ... ... | 1 | 174 | 2 | 0 | 1 | 0 | 0 | 0 |
| No. 3 ,, ... ... ... | 2 | 414 | 14 | 0 | 0 | 0 | 1 | 1 |
| No. 4 ,, ... ... ... | 3 | 74 | 2 | 0 | 2 | 0 | 0 | 1 |
| No. 5 ,, ... ... ... | 3 | 71 | 5 | 0 | 1 | 1 | 1 | 0 |
| No. 6 ,, ... ... ... | 2 | 66 | 7 | 0 | 0 | 1 | 1 | 0 |
| Clear water well (filtered) ... ... | 20 | 90 | 10 | 0 | 5 | 3 | 10 | 2 |
| Campbell Road main (filtered) ... | 17 | 82 | 8 | 0 | 4 | 6 | 6 | 1 |
| Campbell Road main *— | | | | | | | | |
| Chlorination tests of ... ... ... | 14 | 28 | 1 | 9 | 4 | 0 | 1 | 0 |
| Maxwell Hill ... ... ... ... | 50 | 35 | 1 | 22 | 10 | 11 | 7 | 0 |
| Weld Hill ... ... ... ... | 44 | 76 | 7 | 0 | 2 | 14 | 16 | 12 |
| Chemical laboratory tap † ... ... | 6 | 67 | 2 | 0 | 1 | 3 | 1 | 1 |
| Sentul Housing Scheme— | | | | | | | | |
| (*a*) Raw water ... ... ... | 4 | 11 | 0 | 1 | 0 | 2 | 1 | 0 |
| (*b*) Filtered water ... ... ... | 41 | 13 | 0 | 31 | 0 | 7 | 3 | 0 |
| (*c*) Chlorinated water ... ... | 37 | 8 | 0 | 31 | 2 | 3 | 1 | 0 |
| (*d*) Alum and filter ... ... ... | 1 | 14 | 7 | 1 | 0 | 0 | 0 | 0 |
| Estate No. 12 ... ... ... ... | 1 | 403 | 2 | 0 | 0 | 1 | 0 | 0 |
| Swimming Pool, Kuala Langat ... | 1 | 43 | 9 | 0 | 0 | 0 | 0 | 1 |
| Estate No. 8— | | | | | | | | |
| (*a*) Raw ... ... ... ... | 1 | 252 | 14 | 0 | 0 | 0 | 0 | 1 |
| (*b*) Treated ... ... ... ... | 2 | 79 | 1 | 2 | 0 | 0 | 0 | 0 |
| Serdang Stream ... ... ... ... | 1 | 83 | 3 | 0 | 0 | 0 | 0 | 1 |
| Reservoir ... ... ... ... | 1 | 27 | 2 | 0 | 0 | 0 | 0 | 1 |
| Cement well, S.B. cooly lines ... | 1 | 68 | 1 | 0 | 0 | 0 | 1 | 0 |
| Earth well, Police Station ... ... | 1 | 184 | 25 | 0 | 0 | 0 | 0 | 1 |
| Estate No. 9 ... ... ... ... | 1 | 4 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sungei Besi— | | | | | | | | |
| (*a*) Raw water existing inlet ... | 1 | 30 | 2 | 0 | 0 | 0 | 1 | 0 |
| (*b*) Raw water proposed intake ... | 1 | 66 | 3 | 0 | 0 | 0 | 1 | 0 |
| **PERAK.** | | | | | | | | |
| Tapah (Batang Padang): | | | | | | | | |
| River water ... ... ... ... | 1 | 228 | 35 | 0 | 0 | 0 | 0 | 1 |
| Chenderiang Headworks— | | | | | | | | |
| (*a*) Raw water ... ... ... | 5 | 374 | 48 | 0 | 0 | 0 | 0 | 5 |
| (*b*) Filtered ... ... ... ... | 5 | 128 | 20 | 0 | 1 | 1 | 1 | 2 |
| Estate No. 10 ... ... ... ... | 4 | 1-countless<br>3-30 | 1 | 0 | 2 | 1 | 0 | 1 |
| Estate No. 4 ... ... ... ... | 2 | 63 | 5 | 0 | 0 | 0 | 0 | 2 |
| Sungei Gading ... ... ... ... | 3 | 185 | 48 | 0 | 0 | 0 | 0 | 3 |
| Tapah Road Malay Boys' School ... | 2 | 1-countless<br>1·2,174 | 60 | 0 | 0 | 0 | 0 | 2 |

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* These were repeated twice, and a sterile sample was produced during the second chlorination.

† The supply to tap in chemical laboratory comes from Weld Hill Reservoir.

| Source. | No. of samples received during the year. | Average number of bacteria per c.cm. on ordinary agar at 37°C. after 48 hours. | Average number of bacteria per c.cm. on MacConkey's lactose peptose bile salt agar after 48 hours. | Lactose Fermenters. | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Not detected in 10 c.cms. | Detected in | | | |
| | | | | | 10 c.cms. | 5 c.cms. | 1 c.cm. | 0.1 c.cms. |
| PERAK—(*cont.*). | | | | | | | | |
| Tanjong Malim— | | | | | | | | |
| Tanjong Malim River: | | | | | | | | |
| Raw water ... ... ... ... | 1 | 828 | 194 | 0 | 0 | 0 | 0 | 1 |
| Filtered ... ... ... ... | 1 | 10 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sultan Idris Training College, Tanjong Malim— | | | | | | | | |
| Sump ... ... ... ... | 1 | 162 | 3 | 0 | 0 | 0 | 0 | 1 |
| Raw water ... .. ... ... | 3 | 552 | 79 | 0 | 0 | 0 | 0 | 3 |
| Filtered water ... ... ... | 4 | 48 | 2 | 2 | 1 | 0 | 0 | 1 |
| Concrete well— | | | | | | | | |
| (*a*) Raw water ... ... ... | 1 | 997 | 186 | 0 | 0 | 0 | 0 | 1 |
| (*b*) Filtered water ... ... | 1 | 221 | 17 | 0 | 0 | 0 | 0 | 1 |
| Estate No. 11 ... ... ... ... | 1 | 398 | 88 | 0 | 0 | 0 | 0 | 1 |
| Kuala Kangsar— | | | | | | | | |
| Chenderoh Dam: | | | | | | | | |
| (*a*) Raw water ... ... ... | 2 | 393 | 29 | 0 | 0 | 0 | 1 | 1 |
| (*b*) Filtered ... ... ... | 2 | 27 | 3 | 0 | 2 | 0 | 0 | 0 |
| Enggor Town ... ... ... ... | 1 | 1,203 | 234 | 0 | 0 | 0 | 0 | 1 |
| Selama Town ... ... ... ... | 1 | 702 | 35 | 0 | 0 | 0 | 0 | 1 |

## Milk.

### TABLE XIV.

| Source. | No. of samples received. | Quantity of milk from which coliform organisms were isolated. | | | | Organisms isolated. |
|---|---|---|---|---|---|---|
| | | 1 c.c. undiluted. | 1 c.c. of 1-10. | 1 c.c. of 1-100. | 1 c.c. of 1-1000. | |
| Ipoh ... ... ... | 6 | 3 | 1 | 2 | 0 | *Achromobacter coccoidum. B. faecalis alcaligenes. Aerobacter cloacae, B. vesiculosis-* |
| Kuala Lumpur ... | 4 | 0 | 2 | 0 | 2 | *B. lactis aerogenes, E. acidi lactici, B. faecalis alcaligenes, E. coscoroba. M. mucofaciens, E. communior Achromobacter coccoidum.* |
| Kuala Kangsar ... | 2 | 0 | 0 | 0 | 2 | *Aerobacter cloacae. Achromobacter coccoidum, B. lactis aerogenes.* |
| Kuala Lumpur (reconstituted milk)* | 5 | 0 | †3 | 2 | 0 | *M. mucofaciens and B. lactis aerogenes.* |
| Kuala Lumpur (a milk powder) | 1 | 0 | 0 | 0 | 0 | *M. mucofaciens.* |

* These samples were taken at different stages of a process of milk reconstitution. † Acid only.

## Canned Food.

Two specimens of sardines were found bacteriologically sterile.

## Sewage Effluents.

Nine pooled specimens examined bacteriologically for the Health Office, Kuala Lumpur.

## DIVISION OF PATHOLOGY.

(Dr. R. Lewthwaite, Acting.)

### Rabies Prophylaxis.

The "C" strain of fixed virus, obtained in 1924 from the Pasteur Institute, Coonor (originally from the Pasteur Institute, Paris), was in the 696th passage at the end of 1929: the "L" strain, from Colombo, was in its 336th passage. Virulence has remained fixed, and each batch of vaccine is a mixture of the two strains.

The two strains obtained from the Pasteur Institute, Saigon, in 1927, have only been passed a few times, and have not been used for vaccine production. One of them, originally fixed some thirty years ago in Paris, have now completed 1,636 passages, while the younger strain, fixed from a case of "street" rabies in Saigon, has completed 62 passages.

### Results of Anti-rabies Treatment.

*(Arranged according to the recommendations of the Health Organisation, League of Nations.)*

Patients treated with vaccine prepared at the Institute for Medical Research, Kuala Lumpur.

1. Method of treatment: Semple's.

(*a*) Scheme of dosage for light, medium and severe cases—

Light and medium cases ... ... 14 daily injections of 2 × 2.5 c.cms.

Severe cases ... ... ... 21 daily injections of 2 × 2.5 c.cms.

(*b*) If a preservative such as glycerine or carbolic acid is used, during what period of preservation is the vaccine considered efficient?

Unused vaccine is discarded when six months old.

| | No. of cases. | | Percentage of total. | No. of fatal cases. | |
|---|---|---|---|---|---|
| | 1928. | 1929. | 1929. | 1928. | 1929. |
| 2. Statistics of all patients | 146 | 203 | — | 1 | 0 |
| Classification according to race— | | | | | |
| Europeans | 41 | 52 | 25.62 | — | — |
| Eurasians | 9 | 13 | 6.40 | — | — |
| Indians | 64 | 82 | 40.39 | — | — |
| Malays | 6 | 15 | 7.39 | — | — |
| Chinese | 26 | 41 | 20.20 | 1 | 0 |

Table XV.

The Distribution of the Cases Treated.

| Nationality. | Institute for Medical Research. | District Hospital, K.L. | European Hospital, K.L. | General Hospital, Seremban. | Straits Settlements. | Kedah. | Kelantan. | Total. |
|---|---|---|---|---|---|---|---|---|
| Europeans | 30 | — | 16 | — | — | 5 | 1 | 52 |
| Eurasians | 13 | — | — | — | — | — | — | 13 |
| Indians | 44 | 21 | — | 3 | 1 (Pg.) | 13 | — | 82 |
| Malays | 4 | — | — | — | — | 11 | — | 15 |
| Chinese | 16 | 14 | — | 1 | 1 (S'pre) | 7 | 2 | 41 |

5. Classification according to variety of biting animal: All cases were bitten by, or merely contacts with, dogs except two which were contacts with a rabid calf.

| | No. of cases. 1928. | No. of cases. 1929. | Percentage of total. | No. of fata cases. |
|---|---|---|---|---|
| 6. Depth of lesion— | | | | |
| Deep and superficial | 55 | 86 | — | — |
| No visible lesion | 91 | 117 | — | — |
| 7. Interposition of clothing— | | | | |
| On bare skin | 27 | 67 | 77.9 | — |
| Through clothing | 28 | 19 | 22.1 | — |
| 8. Position of bite— | | | | |
| Head | 1 | 7 | 8.75 | — |
| Arm | 22 | 39 | 48.75 | — |
| Trunk | 1 | 7 | 8.75 | — |
| Leg | 31 | 27 | 33.75 | 1 |
| Not reported | — | 6 | — | — |
| 9. Number of days after bite or contact when treatment was begun— | | | | |
| 0 to 4 | 84 | 93 | 50.0 | — |
| 5 to 7 | 30 | 43 | 23.12 | — |
| 8 to 14 | 19 | 28 | 15.05 | — |
| 15 to 21 | 5 | 14 | 7.53 | — |
| Over 21 | 8 | 8 | 4.3 | — |
| Not reported | — | 17 | — | — |

10. Any further information or facts pertaining to the above figures—

Paragraph 6.—"No visible lesion 117". The number 117 is the number of those actually bitten but with no visible lesion at the time of consultation, together with the number of contacts with saliva, e.g., licked.

11. If paralytic accidents have been observed during the year please give as detailed information as possible—Nil.

## Information regarding Fatal Cases of Rabies.

There were two cases recorded during the year. Neither of these two had sought treatment.

(i) A male Tamil living at Kuala Lumpur, aged 50 years, was admitted to the District Hospital, after three days illness. He was weak and emaciated and had not taken food for two days. Spasmodic contractions of muscles of neck and pharynx were present and a typical attack, with facies of mental anguish, was precipitated by an attempt to drink water. There was a history of a dog bite four months previously and the dog was said to have died three days after biting.

Post-mortem findings: Brain congested. Slight excess of cerebro-spinal fluid beneath the arachnoid and in venticles. Smears and section of the brain showed no negri bodies but an inoculated rabbit showed symptoms of rabies in 20 days. Negri bodies were seen in smears and in sections of the rabbits brain. Passage to another rabbit resulted in symptoms after 17 days and negri bodies were also found in the brain of the second animal.

(ii) A Tamil male, aged 56, residing at Klang, was admitted to the District Hospital. He complained of inability to swallow, and of painful spasms. There was a history of a dog bite nine weeks earlier.

Post-mortem findings: Cerebro-spinal fluid slightly increased. No other microscopic abnormality was seen. Negri bodies were present in sections and animal inoculations gave positive findings.

## Occurrence of Rabies in Animals.

Animal brains to a total number of 165 were submitted for examination.

The following table shows the result of examination of these brains, and the areas from which they were sent:

TABLE XVI.

*(All brains from dogs except where stated otherwise.)*

| | Positive. | Negative. | Remarks. |
|---|---|---|---|
| Selangor | 48 | 61 | Positive: 47 dog's; 1 calf's.<br>Negative: 57 dog's; 3 cat's, 1 moosang. |
| Perak | — | 3 | |
| Negri Sembilan | 5 | 8 | Positive: 4 dog's; 1 calf's.<br>Negative: 7 dog's; 1 moosang's. |
| Pahang | — | 2 | |
| Kedah | 17 | 8 | |
| Malacca | — | 3 | |
| Penang | — | 2 | |
| Singapore | — | 1 | |
| Kelantan | 2 | — | |
| | 72 | 88 | |

There were five brains, two from Selangor (dog's), two from Perak (dog's), and one (cat's) from Penang, on which no report could be made because of putrefactive changes.

## Prophylactic Inoculation of Dogs.

In Selangor, 1,308 dogs were inoculated during the year 1929, as compared with 1,244 in 1928. Twenty dogs were inoculated in Malacca and Negri Sembilan.

During the year 14,857 c.cms. of anti-rabic canine vaccine was supplied to the Veterinary Department.

## Miscellaneous Examinations.

| | | | |
|---|---|---|---|
| Urine examinations | | | =166 (78 urinary sugar estimations) |
| Biochemical Investigations: | | | |
| Diazo | | 1 | = 61 |
| Blood sugar | | 10 | |
| Glucose tolerance | | 21 | |
| Van den Bergh | | 9 | |
| Blood urea | | 6 | |
| Urea conc. test | | 10 | |
| Test meals | | 4 | |
| Blood smears, differential and total counts, etc. | | | = 16 |
| Cerebro-spinal fluids | | | = 60 |
| Faeces | | | = 47 |
| Pathological fluids: | | | |
| Ascitic fluid | | 11 | = 33 |
| Pleuritic fluid | | 15 | |
| Liver abscess | | 7 | |
| Sputum | | | 3 |
| Miscellaneous | | | 13 |
| Medico-legal exhibits: | | | |
| Blood and semen: | | 10 | = 52 |
| Blood positive | 6 | | |
| Blood negative | 4 | | |
| Semen negative | 10 | | |
| Semen only: | | 33 | |
| Positive | 7 | | |
| Negative | 26 | | |
| Hairs | | 4 | |
| Charred skeletal remains | | 1 | |
| Action of suspected mydriatics | | 3 | |
| Miscellaneous | | 1 | |

## Autopsies.

*Post-mortem examinations have been carried out in 578 unclaimed bodies.*

Table XVII.

| | | |
|---|---|---|
| Amoebiasis (intestinal) | | 28 |
| Amoebiasis (liver abscess) | | 2 |
| Ankylostomiasis | | 16 |
| Arterio-sclerosis | | 13 |
| Anaemia (secondary) | | 3 |
| Anaemia (pernicious) | | 7 |
| Aneurysm | | 1 |
| Appendicitis | | 1 |
| Ascariasis (one with abscesses in liver) | | 4 |
| Beri-beri | | 10 |
| Bronchopneumonia | | 6 |
| Cellulitis | | 11 |
| Cholangitis | | 1 |
| Clonorchis sinenesis | | 2 |
| Cystitis | | 1 |
| Dermatites exfliative arsenial | | 1 |
| Dysentery—bacillary | | 62 |
| Dysentery—mixed | | 4 |
| Eclampsia | | 1 |
| Empyema | | 4 |
| Erysipelas | | 1 |
| Ulcerative endocarditis— | | |
| Affecting aortic valve | 3 | 9 |
| Mitral | 5 | |
| Tricuspid | 1 | |
| Fracture of skull | | 1 |
| Gangrene | | 1 |
| Haemorrhage cerebral— | | |
| One recent | | 2 |
| One old—softening brain | | |
| Haemorrhagic encephalitis | | 1 |
| Hydrophobia | | 2 |
| Hydronephrosis | | 1 |
| Intussusception | | 1 |
| Keratomalacia | | 1 |
| Leprosy | | 4 |
| Leptospirosis | | 1 |
| Leukaemia—lymphatic | | 2 |
| Leukaemia—myelogenous | | 2 |
| Liver—cirrhosis | | 15 |
| Liver—primary carcinoma (all Chinese) | | 6 |
| Lung—bronchitis, acute | | 1 |
| Lung—bronchitis, chronic | | 2 |
| Lung—bronchiectasis | | 2 |
| Lung—abscess (one spirochaetal) | | 4 |
| Malaria | | 43 |
| Malaria—chronic (cachexia) | | 12 |
| Melioidosis (cultures from two prostatic abscesses—positive) | | 4 |
| Meningitis— | | |
| One pneumococcal | | 4 |
| Three meningococcal | | |
| Myocarditis | | 1 |

| | |
|---|---|
| Nephritis—chronic interstitial | 17 |
| Nephritis—chronic parenchymatous | 13 |
| Nephritis—suppurnative | 6 |
| Osteomyelitis (three tuberculous) | 5 |
| Paratyphoid fever | 1 |
| Pericarditis | 4 |
| Peritonitis | 4 |
| Pneumonia | 56 |
| Pneumonia—interstitial | 2 |
| Pleurisy | 3 |
| Prostatis | 3 |
| Pyaemia | 1 |
| Pyosalpinx | 1 |
| Septicaemia | 2 |
| Sepsis | 5 |
| Stomach ulcer | 2 |
| Subphrenic abscess | 1 |
| Syphilis | 2 |
| Tetanus (clinically) (cultures from wound—negative) | 2 |
| Tuberculosis | 106 |
| Tumours | 25 |
| Typhoid fever | 5 |
| Typhus fever (tropical) | 5 |
| Ulcerative colitis | 1 |
| Urinary calculus | 1 |
| Undiagnosed | 4 |

## Morbid Histology.

The total number of specimens received for histological diagnosis numbered 339. In addition, 302 specimens from post-mortem examinations were also examined.

Details of benign and malignant tumours are given in the following tables:

### Table XVIII.

### Benign Tumours.

| Case No. | Nationality. | Serial No. | Sex. | Age. | Site of tumour. | Nature of tumour. |
|---|---|---|---|---|---|---|
| 1 | Chinese ... | 81 | M. | 53 | Left buttock ... ... | Papilloma |
| 2 | ,, ... | 90 | M. | 25 | Mastoid region... ... | Hard fibroma |
| 3 | ,, ... | 97 | M. | 49 | Flank ... ... ... | Lipoma |
| 4 | ,, ... | 149 | M. | 60 | Forearm ... ... | Fibroma |
| 5 | ,, ... | 151 | F. | 46 | Uterus ... ... ... | Hydatidiform mole |
| 6 | ,, ... | 179 | M. | 19 | External ear ... ... | Papilloma |
| 7 | ,, ... | 183 | M. | 35 | Left leg... ... ... | Cavernous lymphangioma |
| 8 | ,, ... | 186 | F. | 55 | Ovary ... ... ... | Fibroma |
| 9 | ,, ... | 189 | F. | 22 | Neck ... ... ... | Teratoma |
| 10 | ,, ... | 191 | F. | 34 | Uterus ... ... ... | Fibromyoma |
| 11 | ,, ... | 221 | M. | 38 | Face ... ... ... | Cavernous haemangioma |
| 12 | ,, ... | 226 | F. | 2 | — ... ... ... | Dermoid cyst |
| 13 | ,, ... | 232 | M. | 7 | Axilla ... ... ... | Lipoma |
| 14 | ,, ... | 173 | F. | 29 | General distribution ... | Neurofibromatosis |
| 15 | ,, ... | 326 | F. | 50 | Ovary ... ... ... | Cystadenoma |
| 16 | ,, ... | 363 | M. | 40 | Head ... ... ... | Recurrent fibroma |
| 17 | Tamils ... | 41 | M. | 25 | Arm ... ... ... | Lipoma |
| 18 | ,, ... | 56 | M. | 27 | Breast ... ... ... | Fibroadenoma |
| 19 | ,, ... | 94 | F. | 30 | Vaginal wall ... ... | Fibroma |
| 20 | ,, ... | 95 | F. | 20 | Ovary ... ... ... | Papillomatous cyst |
| 21 | ,, ... | 102 | F. | 45 | Mouth ... ... ... | Papilloma |
| 22 | ,, ... | 120 | F. | ... | Thyroid ... ... | Adenoma |
| 23 | ,, ... | 123 | F. | 38 | Uterus ... ... ... | Fibromyoma |
| 24 | ,, ... | 161 | F. | 30 | Ovary ... ... ... | Cyst |
| 25 | ,, ... | 171 | M. | 35 | Thumb ... ... ... | Myeloma |
| 26 | ,, ... | 245 | F. | 28 | Ileum ... ... ... | Adenoma |
| 27 | ,, ... | 255 | F. | 28 | Head ... ... ... | Haemangioma |
| 28 | ,, ... | 330 | M. | 35 | Foot ... ... ... | Fibroma |
| 29 | ,, ... | 370 | F. | 12 | Jaw ... ... ... | Fibroid epulis |
| 30 | ,, ... | 9 | M. | 22 | Thumb ... ... ... | Papilloma |
| 31 | Malay ... | 36 | F. | 30 | Thyroid... ... ... | Cystadenoma |
| 32 | ,, ... | 168 | M. | 10 | Ankle ... ... ... | Keloid |
| 33 | ,, ... | 223 | M. | 39 | Thyroid ... ... | Adenoma |
| 34 | ,, ... | 232 | M. | 20 | Breast ... ... ... | Fibroma |
| 35 | Japanese | 158 | F. | 50 | Cervix ... ... ... | Papilloma |
| 36 | Sikh ... | 122 | M. | 25 | Scalp ... ... ... | Haemangioma |
| 37 | European | 28 | F. | 20 | Nose ... ... ... | Dermoid |
| 38 | ,, ... | 126 | F. | 21 | Gum ... ... ... | Epulis |
| 39 | ,, ... | 169 | F. | 21 | Gum ... ... ... | Recurrent epulis |
| 40 | ,, ... | 274 | M. | 47 | Tongue ... ... ... | Fibroma |
| 41 | Eurasian | 110 | F. | 23 | Breast ... ... ... | Fibroadenoma |

## Malignant Tumours.

### Table XIX.

| Case No. | Nationality. | Serial No. | Sex. | Age. | Site of tumour. | Nature of tumour. |
|---|---|---|---|---|---|---|
| 1 | Chinese ... | 11 | F. | 47 | Buttock ... ... | Epithelioma |
| 2 | „ ... | 12 | M. | 43 | Caecum ... ... ... | Adenocarcinoma |
| 3 | „ ... | 19 | M. | 22 | Kidney ... ... ... | Secondary deposit, lumphosarcoma |
| 4 | „ ... | 54 | M. | 56 | Foot ... ... ... | Epithelioma |
| 5 | „ ... | 55 | M. | 51 | Neck ... ... ... | Small round-cell sarcoma |
| 6 | „ ... | 59 | M. | 20 | Face ... ... ... | Myxosarcoma |
| 7 | „ ... | 60 | M. | 36 | Mastoid region... ... | Spheroidal-cell carcinoma |
| 8 | „ ... | 67 | M. | 58 | Axilla ... ... ... | Large round-cell sarcoma |
| 9 | „ ... | 72 | F. | 41 | Cervical glands ... | Secondary sarcoma |
| 10 | „ ... | 76 | M. | 47 | Stomach ... ... | Adenocarcinoma |
| 11 | „ ... | 82 | F. | 41 | Forehead ... ... | Carcinoma |
| 12 | „ ... | 86 | M. | 49 | Penis ... ... ... | Epithelioma |
| 13 | „ ... | 87 | M. | 53 | Stomach ... ... | Colloid carcinoma |
| 14 | „ ... | 88 | M. | 53 | Liver ... ... ... | Primary carcinoma |
| 15 | „ ... | 89 | M. | 58 | Tongue ... ... ... | Malignant papilloma |
| 16 | „ ... | 93 | M. | 39 | Neck ... ... ... | Secondary carcinoma |
| 17 | „ ... | 99 | F. | 50 | Perinaeum ... ... | Epithelioma |
| 18 | „ ... | 109 | F. | 50 | Breast ... ... ... | Carcinoma |
| 19 | „ ... | 113 | F. | 45 | Ovary ... ... ... | Malignant papilliferous cyst |
| 20 | „ ... | 116 | M. | 31 | Axillary glands ... | Secondary carcinoma |
| 21 | „ ... | 128 | F. | 36 | Soft palate ... ... | Adenocarcinoma |
| 22 | „ ... | 135 | M. | 36 | Penis ... ... ... | Epithelioma |
| 23 | „ ... | 154 | M. | ... | Orbit ... ... ... | Carcinoma |
| 24 | „ ... | 159 | M. | 41 | Lower eyelid ... ... | Carcinoma |
| 25 | „ ... | 160 | M. | 37 | Cervical gland ... ... | Secondary carcinoma |
| 26 | „ ... | 176 | F. | 47 | Breast ... ... ... | Spheroidal-cell carcinoma |
| 27 | „ ... | 177 | F. | 52 | Breast ... ... ... | Carcinoma |
| 28 | „ ... | 182 | M. | 45 | Maxillary antrum ... | Sarcoma |
| 29 | „ ... | 194 | M. | 8 | Anus ... ... ... | Carcinoma |
| 30 | „ ... | 196 | M. | 37 | — ... | Epithelioma |
| 31 | „ ... | 198 | F. | 43 | Neck ... ... ... | Secondary epithelioma |
| 32 | „ ... | 200 | M. | 36 | Tongue ... ... ... | Epithelioma |
| 33 | „ ... | 206 | M. | 58 | Lung; liver ... ... | Secondary sarcoma |
| 34 | „ ... | 215 | M. | 33 | Stomach ... ... | Columnar-cell carcinoma |
| 35 | „ ... | 222 | M. | 50 | Neck ... ... ... | Mixed-cell sarcoma |
| 36 | „ ... | 225 | F. | ½ | Wrist ... ... ... | Sarcoma |
| 37 | „ ... | 227 | M. | 43 | Lung, heart and kidney | Melanotic sarcoma |
| 38 | „ ... | 236 | M. | 50 | Axilla ... ... ... | Melanotic sarcoma |
| 39 | „ ... | 237 | M. | 24 | Retroperitoneal ... | Small round-cell sarcoma |
| 40 | „ ... | 246 | F. | 50 | Cervical glands .. | Secondary carcinoma |
| 41 | „ ... | 250 | M. | 38 | Liver ... ... ... | Primary carcinoma |
| 42 | „ ... | 256 | M. | 48 | Mediastinum ... ... | Lymphosarcoma |
| 43 | „ ... | 257 | F. | 27 | Cervix ... ... ... | Epithelioma |
| 44 | „ ... | 259 | M. | 46 | Stomach ... ... | Scirrhous carcinoma |
| 45 | „ ... | 260 | M. | 60 | Leg ... ... ... | Epithelioma |
| 46 | „ ... | 261 | M. | 48 | Stomach ... ... | Adenocarcinoma |
| 47 | „ ... | 262 | M. | 42 | Penis ... ... ... | Epithelioma |
| 48 | „ ... | 271 | M. | 50 | „ ... ... ... | „ |
| 49 | „ ... | 288 | M. | 37 | „ ... ... ... | „ |
| 50 | „ ... | 294 | M. | 58 | Liver ... ... ... | Primary carcinoma |
| 51 | „ ... | 310 | M. | 73 | Scalp ... ... ... | Epithelioma |
| 52 | „ ... | 312 | M. | 60 | „ ... ... ... | Epithelioma |
| 53 | „ ... | 316 | M. | 60 | Upper lip ... ... | Epithelioma |
| 54 | „ ... | 317 | M. | 53 | Liver ... ... ... | Primary carcinoma |
| 55 | „ ... | 320 | M. | 42 | Lung and liver... ... | Secondary sarcoma |
| 56 | „ ... | 322 | M. | 46 | Submaxillary gland ... | Endothelioma |
| 57 | „ ... | 324 | F. | 60 | Groin ... ... ... | Epithelioma |
| 58 | „ ... | 337 | M. | 37 | Glands of neck... ... | Endothelioma |
| 59 | „ ... | 350 | M. | 52 | Stomach ... ... | Columnar-cell carcinoma |
| 60 | „ ... | 356 | M. | 18 | Parotid ... ... ... | Endothelioma |
| 61 | „ ... | 362 | M. | 42 | Iliac region ... ... | Lymphosarcoma |
| 62 | „ ... | 1 | M. | 54 | Liver ... ... ... | Primary carcinoma |
| 63 | „ ... | 3 | M. | 52 | Penis ... ... ... | Epithelioma |
| 64 | „ ... | 5 | M. | ... | Scalp ... ... ... | Fibrosarcoma |

| Case No. | Nationality. | Serial No. | Sex. | Age. | Site of tumour. | Nature of tumour. |
|---|---|---|---|---|---|---|
| 65 | Tamil | 22 | F. | 30 | Axillary gland | Secondary carcinoma |
| 66 | ,, | 49 | M. | 30 | Tongue | Epithelioma |
| 67 | ,, | 51 | F. | 30 | Cheek | Epithelioma |
| 68 | ,, | 53 | F. | 33 | Leg | Spindle-cell sarcoma |
| 69 | ,, | 78 | M. | 22 | Hard Palate | Mixed-cell sarcoma |
| 70 | ,, | 80 | F. | 50 | Head | Epithelioma |
| 71 | ,, | 92 | F. | 30 | Cheek | ,, |
| 72 | ,, | 108 | M. | 30 | ,, | ,, |
| 73 | ,, | 124 | M. | 35 | Jaw | ,, |
| 74 | ,, | 129 | M. | 52 | Maxillary antrum | Mixed-celled sarcoma |
| 75 | ,, | 131 | M. | 35 | Cheek | Epithelioma |
| 76 | ,, | 132 | F. | 45 | Breast | Carcinoma |
| 77 | ,, | 139 | M. | 37 | Cheek | Epithelioma |
| 78 | ,, | 145 | F. | 40 | Jaw | ,, |
| 79 | ,, | 146 | M. | 35 | Lip | ,, |
| 80 | ,, | 153 | M. | 24 | Leg | Spindle-cell sarcoma |
| 81 | ,, | 167 | M. | 50 | Glans penis | Epithelioma |
| 82 | ,, | 188 | M. | 40 | Soft palate | ,, |
| 83 | ,, | 218 | F. | 28 | Breast | Carcinoma |
| 84 | ,, | 224 | F. | 40 | Labia majora | Epithelioma |
| 85 | ,, | 235 | F. | 25 | Clitoris | ,, |
| 86 | ,, | 249 | M. | 40 | Neck | ,, |
| 87 | ,, | 289 | M. | 50 | Penis | ,, |
| 88 | ,, | 309 | F. | 36 | Uterus | Sarcoma |
| 89 | ,, | 319 | M. | 28 | Cheek | Epithelioma |
| 90 | ,, | 335 | M. | 30 | Mandible | ,, |
| 91 | ,, | 341 | M. | 35 | Ileum | Adenocarcinoma |
| 92 | ,, | 349 | M. | 40 | Parotid | Endothelioma |
| 93 | ,, | 360 | M. | 25 | Testis | Teratoma |
| 94 | ,, | 367 | M. | 35 | Foot | Melanotic sarcoma |
| 95 | ,, | 10 | F. | 35 | Oesophagus | Squamous-cell carcinoma |
| 96 | Malay | 57 | M. | 21 | Parotid | Endothelioma |
| 97 | ,, | 58 | F. | 30 | Breast | Carcinoma |
| 98 | ,, | 119 | M. | 65 | Parotid | Endothelioma |
| 99 | ,, | 70 | M. | 25 | Arm | Spindle-cell sarcoma |
| 100 | ,, | 91 | M. | ... | Orbit | Epithelioma |
| 101 | ,, | 136 | M. | 28 | Arm | ,, |
| 102 | ,, | 163 | M. | 35 | Lip | ,, |
| 103 | ,, | 172 | F. | 35 | Glands | Secondary carcinoma |
| 104 | ,, | 192 | F. | 25 | Glands, neck | Secondary epithelioma |
| 105 | ,, | 208 | M. | 53 | Glands, groin | * Lymphogranulomatosis (Hodgkin's disease) |
| 106 | ,, | 238 | F. | 18 | Thigh | Fibrosarcoma |
| 107 | ,, | 247 | M. | 20 | Legs | Epithelioma |
| 108 | ,, | 286 | M. | 67 | Nose | ,, |
| 109 | ,, | 290 | M. | 40 | Elbow | ,, |
| 110 | ,, | 336 | M. | 22 | Glands, neck | * Lymphogranulomatosis (Hodgkin's disease) |
| 111 | ,, | 7 | M. | 80 | Limbus, cornea | Squamous-cell carcinoma |
| 112 | ,, | 8 | M. | 67 | Nose | ,, ,, |
| 113 | Javanese | 220 | M. | 50 | Forehead | Rodent ulcer |
| 114 | Sikh | 50 | M. | 38 | Glands, neck | * Lymphogranulomatosis (Hodgkin's disease) |
| 115 | ,, | 233 | M. | 50 | Penis | Epithelioma |
| 116 | European | 64 | M. | 50 | Skin of back | Melanotic sarcoma |
| 117 | ,, | 98 | F. | 30 | Cervix | Carcinoma |
| 118 | ,, | 100 | M. | 38 | Small intestine | Adenocarcinoma |
| 119 | ,, | 105 | M. | 42 | Nose | Rodent ulcer |
| 120 | ,, | 121 | M. | ... | — | ,, |
| 121 | ,, | 187 | M. | 46 | Jaw | Epithelioma |
| 122 | Eurasian | 170 | F. | 33 | Breast | Carcinoma |

* These cases are included in the above table for purposes of record.

## WASSERMANN AND KAHN REACTIONS.

(*Including specimens examined at the Ipoh Branch Laboratory.*)

The total number of specimens received for examination numbered 17,784. Of these 987 were found unfit for examination, on account of lysis or bacterial contamination, and 175 sera (1.1 per cent.) were anticomplimentary. Transit of specimens from some of the outlying districts may take as long as two days.

TABLE XX.

RESULTS OF WASSERMANN REACTIONS.

| | Positive. | Negative. | Unsuitable for test. | Anti-complementary. | Total. |
|---|---|---|---|---|---|
| First half, 1929 ... | 3,179 | 6,332 | 714 | 96 | 10,321 |
| Second half, 1929 | 2,854 | 4,257 | 273 | 76 | 7,463 |
| Totals ... | 6,033 | 10,589 | 987 | 175 | 17,784 |
| Percentage ... | 33.7 | 59.7 | 5.5 | 1.1 | 100 |

TABLE XXI.

RESULTS OF KAHN REACTIONS.

| | Positive. | Negative. | Total. |
|---|---|---|---|
| First half, 1929 ... | 1,933 | 2,669 | 4,602 |
| Second half, 1929 ... | 2,882 | 3,716 | 6,598 |
| Totals ... | 4,815 | 6,385 | 11,200 |
| Percentage ... | 42.8 | 57.2 | 100 |

The Kahn Antigen is made in the Institute and standardised against a batch kindly supplied by Dr. Kahn. The test is found to be a valuable check on the Wassermann reaction and is frequently positive in early, tertiary and treated cases when the Wassermann result is negative. On the other hand a few cases have given a negative Kahn result while the Wassermann has been strongly positive.

## DIVISION OF CHEMISTRY.

(MR. R. W. BLAIR.)

### Medical Department.

The chemical work performed for the Medical Department may be classified as follows—

*Milk.*

The following standards are prescribed for milk in the rules of "The Sale of Food and Drugs Enactment, 1913":

(*a*) The quantity of milk fat present in milk must not be less than 3.25 per cent. of the total component parts thereof.

(*b*) The quantity of milk solids, other than milk fat, present in milk must not be less than 8.5 per cent. of the total component parts thereof.

To ascertain whether these provisions are complied with, Officers of the Health Branch collect samples which are examined in this laboratory.

Nine hundred and ninety samples of milk were examined. Of these, 9 (0.9 per cent.) contained less than 3.25 per cent. of milk fat, 89 (8.9 per cent.) contained less than 8.5 per cent. of milk solids other than milk fat, and 5 (0.5 per cent.) were deficient in both milk fat and non-fatty solids.

*Water.*

The total number of chemical examinations of samples of water from existing or proposed supplies was 1,216 as compared with 939 in 1928. In addition, special examinations were carried out on 322 samples of water for the Entomologist in connexion with the oecology of mosquito larvae.

The raw and filtered waters from the Kuala Lumpur Water Supplies were examined weekly. In addition, chemical examinations of samples of the raw and the filtered waters from the new supply at Kuala Sleh, have been carried out. The raw waters are filtered through slow sand filters and the filtered waters conveyed by mains to service reservoirs.

The service reservoirs, with the exception of Maxwell's Hill Reservoir, are covered reservoirs.

The monthly averages of these examinations are shown in Table XXIII, and the yearly averages in Tables XXIV, XXV, XXVI and XXVII.

The averages differ slightly from those for the year 1928, although the rainfall for the year was slightly higher.

Chemical examinations of the raw and filtered waters of the following supplies were carried out monthly : Bagan Serai, Gopeng, Ipoh, Kampar, Klang, Kuala Kubu, Kuala Kangsar, Kuala Lipis, Parit Buntar, Raub, Rawang, Seremban, Sungei Nyamok, Sungei Silibin, Sungei Tamboi, Taiping, Tanjong Rambutan, Tapah, Teluk Anson and Ulu Johan Water Supplies.

The raw, filtered and chlorinated waters from the water supply for the Sentul Housing Scheme were examined weekly during the year.

More attention is being devoted to the provision and maintenance of pure water supplies, and the number of purification plants is increasing.

One sample of chlorinated water from the Klang Water Supply was examined.

### *Sewage Effluents.*

The resulting effluents from a few of the installations in the Federated Malay States have been examined. The number of examinations was in 1929, 33, as compared with 19 in 1928, and the results in the majority of cases have failed to conform with the standards prescribed in the report of the Royal Commission on Sewage Disposal.

### *Toddy.*

One hundred and eight samples of toddy were examined to ascertain if they complied with the standards prescribed in the rules under "The Sale of Food and Drugs Enactment, 1913."

In four samples, the acidity exceeded 0.6 per cent. expressed as acetic acid, and two samples gave indications of adulteration with water. The remainder of the samples complied with the rules.

### *Toxicological Exhibits.*

Thirteen exhibits were submitted by Officers of the Medical Department. Exhibits in connexion with cases of human poisoning numbered 10. Of these, three were human viscera, three stomach washings, one vomit, one water, one food and one medicine.

In one of the viscera, chandu was found and datura was identified in the sample of food.

The viscera from three animals were examined; in one exhibit a salt of bismuth was found.

### *Biochemical Examinations.*

During the year 1929, 229 biochemical examinations were carried out. The work done may be classified as follows:

| | Examinations. |
|---|---|
| Blood serum for calcium ... ... ... ... ... ... | 90 |
| Blood serum for phosphorus ... ... ... ... ... | 35 |
| Blood serum for cholesterol ... ... ... ... ... | 1 |
| Blood serums for calcium, phosphorus and cholesterol ... ... | 13 |
| Blood serums for proteins, albumin and phosphorus ... ... | 19 |
| Blood for uric acid ... ... ... ... ... ... ... | 7 |
| Blood for urea ... ... ... ... ... ... ... | 3 |
| Urine for creatinine and creatine ... ... ... ... ... | 44 |
| Urine for uric acid ... ... ... ... ... ... ... | 5 |
| Miscellaneous ... ... ... ... ... ... ... | 12 |

### *Miscellaneous Exhibits.*

The total number of exhibits was 67. Twelve samples of ether and thirteen samples of chloroform used for anaesthetic purposes were examined.

Other exhibits included 21 samples of samsu for the presence of heavy metals.

## Police Department.

### *Articles for Blood Stains.*

Two hundred and sixteen exhibits in connexion with charges of murder, etc., were received, as compared with 168 in 1928. Blood was found on 95 of these. The exhibits which gave positive reactions for blood were further examined by the precipitin test for human serum. Seventy-eight stains gave the reaction for human serum.

### *Toxicological Exhibits.*

One hundred and twenty-nine exhibits were received for examination as compared with 60 in 1928. The poisons found in the specimens of viscera, stomach wash, vomit and urine received, included acetic acid, arsenic, chandu, copper acetate, datura, formalin, Jeyes fluid, mercuric chloride, muscarine, potassium cyanide and veronal.

The other exhibits submitted included samples of food, medicines, liquids, curry, and in these the poisons found included acetic acid, chandu, copper sulphate, formic acid, jeyes fluid, lysol, mercuric chloride, powdered glass and sodium carbonate.

### *Deleterious Drugs.*

Thirty-two substances suspected to contain deleterious drugs specified in "The Deleterious Drugs Enactment" were examined. "Ganja" was identified in 13 of these exhibits.

### *Miscellaneous Exhibits.*

The number of exhibits examined was 73. They included 11 medicines for poisons under the "Poisons Enactment", 6 exhibits for the presence of datura, 5 bullets for identification, and 3 powders which had been used by Chinese during a raid by Police Officers.

## Other Departments.

Three exhibits for blood stains were examined for the Public Prosecutor, Kelantan, a sample of sweets for suspected poison for the Officer in Charge, Military Hospital, Taiping, a sample of water for the Health Officer, Kedah, and a sample of hair oil and a lottery ticket for the Registrar, Supreme Court.

## Private Analyses.

For the Pahang Consolidated Co. Ltd., Sungei Lembing, seven urines and three waters were examined for the presence of lead.

The other exhibits included samples of tea, rice, whisky, beans and a vomit.

## Legal Proceedings.

Members of the staff of the Chemical Division gave evidence in legal proceedings on two occasions.

### TABLE XXII.

### TOTAL NUMBER OF SAMPLES EXAMINED IN THE CHEMICAL LABORATORY DURING THE YEARS 1928 AND 1929.

| | 1928. | 1929. |
|---|---|---|
| Medical Department— | | |
| Milk | 630 | 990 |
| Water | 965 | 1,538 |
| Sewage Effluents | 19 | 33 |
| Toddy | 81 | 108 |
| Toxicological examinations | 22 | 13 |
| Biochemical examinations | — | 229 |
| Miscellaneous | 112 | 67 |
| Police Department— | | |
| Articles for blood stains | 168 | 216 |
| Toxicological examinations | 61 | 129 |
| Liquors | 7 | — |
| Deleterious drugs | 7 | 32 |
| Miscellaneous | 60 | 73 |
| Other Departments— | | |
| Miscellaneous | 126 | 7 |
| Private Analyses | 54 | 25 |
| Trade and Customs Department | 6,697 | — |
| Police Department (coins and coining materials) | 822 | — |
| Total | 9,831 | 3,460 |

## TABLE XXIII.

## KUALA LUMPUR WATER SUPPLY.

Chemical Averages for each month of the year 1929. Parts per 100,000 (unless otherwise stated).

| Month. | Impounding Reservoir. (Raw Water.) | | | | | | | | | Intake Works, Ampang. (Raw Water.) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Colour M. M. Brown. | pH. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxygen absorbed in 3 hours. | Chlorides as chlorine. | Total solids. | Oxidised nitrogen. | Rainfall in inches. | Colour M. M. Brown. | pH. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxygen absorbed in 3 hours. | Chlorides as chlorine. | Total solids. | Oxidised nitrogen. | Rainfall in inches. |
| January ... ... ... | 30 | 6.5 | .0005 | .0108 | .154 | .06 | 2.0 | .003 | 5.06 | 26 | 6.5 | .0000 | .0066 | .137 | .05 | 3.5 | .009 | 9.17 |
| February ... ... | 28 | 6.7 | .0003 | .0111 | .135 | .08 | 1.2 | .000 | 2.99 | 35 | 6.8 | .0000 | .0048 | .161 | .07 | 3.2 | .006 | 2.82 |
| March ... ... ... | 34 | 6.7 | .0000 | .0109 | .146 | .07 | 2.5 | .006 | 7.48 | 47 | 6.7 | .0001 | .0054 | .213 | .07 | 2.0 | .003 | 11.52 |
| April ... ... ... | 38 | 6.5 | .0001 | .0113 | .152 | .08 | 2.0 | .009 | 8.55 | 48 | 6.4 | .0001 | .0075 | .276 | .07 | 0.7 | .006 | 13.09 |
| May ... ... ... | 35 | 6.4 | .0003 | .0104 | .165 | .07 | 3.2 | .000 | 6.52 | 29 | 6.4 | .0001 | .0046 | .162 | .08 | 2.1 | .003 | 9.19 |
| June ... ... ... | 33 | 6.4 | .0001 | .0098 | .149 | .07 | 2.7 | .003 | 5.35 | 36 | 6.5 | .0000 | .0046 | .152 | .08 | 1.7 | .006 | 8.35 |
| July ... ... ... | 32 | 6.7 | .0001 | .0094 | .139 | .08 | 3.5 | .003 | 1.40 | 33 | 6.7 | .0001 | .0038 | .140 | .07 | 4.2 | .006 | 0.46 |
| August ... ... ... | 24 | 6.5 | .0001 | .0086 | .124 | .08 | 3.2 | .006 | 4.33 | 34 | 6.4 | .0009 | .0054 | .186 | .08 | 4.1 | .000 | 3.98 |
| September ... ... | 32 | 6.5 | .0013 | .0075 | .129 | .10 | 3.6 | .000 | 8.66 | 46 | 6.5 | .0002 | .0061 | .255 | .08 | 4.7 | .007 | 12.86 |
| October ... ... ... | 33 | 6.5 | .0009 | .0094 | .176 | .07 | ... | ... | 13.32 | 32 | 6.5 | .0004 | .0066 | .244 | .07 | ... | ... | 20.84 |
| November ... ... | 36 | 6.5 | .0012 | .0104 | .175 | .07 | ... | ... | 10.26 | 32 | 6.5 | .0003 | .0044 | .155 | .07 | ... | ... | 11.50 |
| December ... ... | 33 | 6.4 | .0001 | .0092 | .157 | .06 | ... | ... | 2.68 | 33 | 6.5 | .0001 | .0048 | .168 | .07 | ... | ... | 5.67 |
| Averages ... | 32 | 6.5 | .0004 | .0099 | .150 | .07 | 2.7 | .003 | 6.38 | 36 | 6.5 | .0002 | .0054 | .187 | .07 | 2.9 | .005 | 9.12 |

| Month. | Maxwell's Hill Reservoir. (Filtered Water.) | | | | | | | | Weld Hill Reservoir. (Filtered Water.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Colour M. M. Brown. | pH. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxygen absorbed in 3 hours. | Chlorides as chlorine. | Total solids. | Oxidised nitrogen. | Colour M. M. Brown. | pH. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxygen absorbed in 3 hours. | Chlorides as chlorine. | Total solids. | Oxidised nitrogen. |
| January ... ... ... | 15 | 6.3 | .0001 | .0040 | .080 | .06 | 1.5 | .006 | 18 | 6.7 | .0000 | .0030 | .093 | .05 | 1.7 | .009 |
| February ... ... | 13 | 6.6 | .0000 | .0038 | .068 | .06 | 1.0 | .006 | 27 | 6.9 | .0000 | .0046 | .127 | .06 | 3.2 | .006 |
| March ... ... .. | 16 | 6.6 | .0000 | .0038 | .075 | .07 | 1.5 | .009 | 34 | 6.8 | .0000 | .0044 | .166 | .07 | 0.7 | .006 |
| April ... ... ... | 20 | 6.3 | .0001 | .0042 | .084 | .06 | 0.7 | .006 | 35 | 6.6 | .0001 | .0038 | .138 | .07 | 1.7 | .003 |
| May ... ... ... | 18 | 6.4 | .0001 | .0050 | .092 | .07 | 4.0 | .000 | 22 | 6.6 | .0001 | .0032 | .114 | .07 | 4.8 | .003 |
| June ... ... ... | 19 | 6.2 | .0000 | .0042 | .088 | .08 | 1.9 | .006 | 23 | 6.6 | .0000 | .0028 | .110 | .07 | 2.5 | .002 |
| July ... ... ... | 18 | 6.6 | .0000 | .0024 | .068 | .07 | 2.5 | .006 | 26 | 6.8 | .0000 | .0030 | .114 | .07 | 3.2 | .006 |
| August ... ... ... | 15 | 6.3 | .0000 | .0036 | .073 | .07 | 4.7 | .003 | 28 | 6.6 | .0001 | .0054 | .169 | .07 | 5.4 | .000 |
| September ... ... | 12 | 6.4 | .0001 | .0028 | .072 | .08 | 1.5 | .003 | 39 | 6.6 | .0000 | .0045 | .185 | .07 | 3.2 | .003 |
| October ... ... ... | 18 | 6.4 | .0005 | .0038 | .124 | .08 | 2.5 | .006 | 30 | 6.6 | .0003 | .0041 | .138 | .07 | 3.0 | .006 |
| November ... ... | 19 | 6.3 | .0000 | .0036 | .098 | .08 | ... | ... | 30 | 6.6 | .0001 | .0040 | .131 | .06 | ... | ... |
| December ... ... | 15 | 6.3 | .0000 | .0043 | .093 | .08 | ... | ... | 28 | 6.5 | .0000 | .0045 | .132 | .07 | ... | ... |
| Averages ... | 17 | 6.4 | .0001 | .0038 | .085 | .07 | 2.2 | .005 | 28 | 6.7 | .0001 | .0039 | .135 | .07 | 2.9 | .005 |

## TABLE XXIV.

### AVERAGES, YEARS 1921-1929.

### KUALA LUMPUR WATER SUPPLY: IMPOUNDING RESERVOIR AT AMPANG (RAW WATER) (HIGH LEVEL SUPPLY).

Parts per 100,000 (unless otherwise stated).

| Years 1921-1929. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxidised nitrogen. | Chlorides as chlorine. | Oxygen absorbed from permanganate 3 hours at 80° F. | Colour M.M. Brown in a 2-ft. tube. | Total solids. | Rainfall in inches. | Reaction pH. |
|---|---|---|---|---|---|---|---|---|---|
| 1921 ... ... | .0006 | .0124 | .002 | .06 | .161 | ... | 4.0 | ... | ... |
| 1922 ... ... | *.0009* | *.0131* | .003 | .07 | .164 | ... | 4.4 | 8.07 | ... |
| 1923 ... ... | .0007 | .0116 | .004 | .07 | *.173* | 22 | 4.0 | 8.41 | ... |
| 1924 ... ... | .0006 | .0111 | .002 | .07 | .151 | 21 | 4.3 | 7.61 | ... |
| 1925 ... ... | .0005 | .0102 | .004 | .07 | .148 | 26 | *4.5* | *11.53* | 7.5 |
| 1926 ... ... | .0004 | .0106 | .003 | .07 | .152 | 29 | 3.8 | 9.21 | 6.5 |
| 1927 ... ... | .0005 | .0107 | .002 | .07 | .134 | *32* | *4.5* | 10.32 | 6.9 |
| 1928 ... ... | .0005 | .0095 | .002 | .07 | .146 | 31 | 3.5 | 7.32 | 6.6 |
| 1929 ... ... | .0004 | .0099 | .003 | .07 | .150 | 32 | 2.7 | 6.38 | 6.5 |
| Averages for 9 years | .0006 | .0110 | .003 | .07 | .153 | 28 | 4.0 | 8.61 | 6.8 |

## TABLE XXV.

### AVERAGES, YEARS 1919-1929.

### KUALA LUMPUR WATER SUPPLY: MAXWELL'S HILL (FILTERED WATER) (HIGH LEVEL SUPPLY).

Parts per 100,000 (unless otherwise stated).

| Years 1919-1929. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxidised nitrogen. | Chlorides as chlorine. | Oxygen absorbed from permanganate 3 hours at 80° F. | Colour M.M. Brown in a 2-ft. tube. | Total solids. | Reaction pH. | Hardness (total). |
|---|---|---|---|---|---|---|---|---|---|
| 1919 ... ... | *.0010* | *.0094* | .010 | *.08* | .074 | ... | ... | ... | ... |
| 1920 ... ... | .0005 | .0074 | .010 | .06 | .083 | ... | *5.5* | ... | *1.6* |
| 1921 ... ... | .0001 | .0047 | *.011* | .06 | .082 | ... | 3.1 | ... | ... |
| 1922 ... ... | .0001 | .0047 | .007 | .07 | .083 | ... | 3.4 | ... | ... |
| 1923 ... ... | .0002 | .0043 | .006 | .07 | *.104* | 18 | 3.5 | ... | ... |
| 1924 ... ... | .0008 | .0055 | .004 | .06 | .089 | 17 | 3.6 | ... | ... |
| 1925 ... ... | .0001 | .0056 | .005 | .07 | .085 | *19* | 4.0 | 7.0 | ... |
| 1926 ... ... | .0000 | .0041 | .005 | .07 | .076 | 16 | 3.2 | 6.0 | 0.1 |
| 1927 ... ... | .0002 | .0041 | .004 | .07 | .070 | 18 | 3.8 | 6.6 | ... |
| 1928 ... ... | .0002 | .0037 | .007 | .07 | .080 | 16 | 2.7 | 6.5 | 0.4 |
| 1929 ... ... | .0001 | .0038 | .005 | .07 | .085 | 17 | 2.2 | 6.4 | 0.4 |
| Averages for 11 years | .0003 | .0052 | .007 | .07 | .082 | 17 | 3.5 | 6.5 | 0.6 |

The highest results are in italics.

## Table XXVI.

### AVERAGES, YEARS 1921-1929.

### Kuala Lumpur Water Supply: Ampang Intake Works (Raw Water).

Parts per 100,000 (unless otherwise stated).

| Years 1921–1929. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxidized nitrogen. | Chlorides as chlorine. | Oxygen absorbed from permanganate 3 hours at 80°F. | Colour M.M. Brown in a 2-ft. tube. | Total solids. | Rainfall in inches. | Reaction pH |
|---|---|---|---|---|---|---|---|---|---|
| 1921 ... ... | .0005 | .0055 | .003 | .06 | .155 | ... | *5.1* | ... | ... |
| 1922 ... ... | .0006 | .0067 | .004 | .06 | .176 | ... | 3.8 | 9.22 | ... |
| 1923 ... ... | *.0008* | .0071 | .005 | .06 | .185 | 24 | 4.0 | 8.74 | ... |
| 1924 ... ... | *.0008* | .0051 | .005 | .05 | .156 | 24 | 4.3 | 8.28 | ... |
| 1925 ... ... | .0005 | .0066 | *.006* | .06 | .170 | 27 | 4.2 | *12.07* | 7.5 |
| 1926 ... ... | .0003 | .0071 | .005 | .06 | .176 | 30 | 3.8 | 9.88 | 6.5 |
| 1927 ... ... | .0003 | .0091 | .004 | .06 | .151 | 34 | 4.5 | 10.68 | 6.8 |
| 1928 ... ... | .0007 | *.0110* | .003 | .06 | *.197* | *37* | 4.2 | 7.29 | 6.7 |
| 1929 ... ... | .0002 | .0054 | .005 | .07 | .187 | 36 | 2.9 | 9.12 | 6.5 |
| Averages for 9 years | .0005 | .0071 | .004 | .06 | .172 | 30 | 4.1 | 8.36 | 6.8 |

## Table XXVII.

### AVERAGES, YEARS 1919-1929.

### Kuala Lumpur Water Supply: Weld Hill (Filtered Water).

Parts per 100,000 (unless otherwise stated).

| Years 1919–1929. | Ammoniacal nitrogen. | Albuminoid nitrogen. | Oxidized nitrogen. | Chlorides as chlorine. | Oxygen absorbed from permanganate 3 hours at 80° F. | Colour M.M. Brown in a 2-ft. tube. | Total solids. | Reaction pH | Hardness (total). |
|---|---|---|---|---|---|---|---|---|---|
| 1919 ... ... | *.0010* | *.0078* | *.010* | *.08* | .111 | ... | ... | ... | ... |
| 1920 ... ... | .0005 | .0064 | .009 | .07 | .126 | ... | *6.0* | ... | *1.6* |
| 1921 ... ... | .0002 | .0044 | .007 | .06 | .120 | ... | 4.4 | ... | ... |
| 1922 ... ... | .0001 | .0048 | .005 | .06 | .132 | ... | 3.5 | ... | ... |
| 1923 ... ... | .0002 | .0046 | .007 | .06 | *.146* | 22 | 3.6 | ... | ... |
| 1924 ... ... | .0003 | .0033 | .006 | .05 | .115 | 21 | 3.8 | ... | ... |
| 1925 ... ... | .0001 | .0044 | .006 | .06 | .105 | *23* | 4.0 | 8.0 | ... |
| 1926 ... ... | .0000 | .0044 | .005 | .06 | .108 | 22 | 3.9 | 7.5 | 0.4 |
| 1927 ... ... | .0001 | .0035 | .004 | .06 | .084 | 22 | 3.9 | 7.1 | ... |
| 1928 ... ... | .0003 | .0037 | .003 | .06 | .119 | *25* | 3.5 | 6.9 | 0.7 |
| 1929 ... ... | .0001 | .0039 | .005 | .07 | .135 | 28 | 2.9 | 6.7 | 0.5 |
| Averages for 11 years ... ... | .0003 | .0046 | .006 | .06 | .118 | 23 | 3.9 | 7.2 | 0.8 |

The highest results are in italics.

## DIVISION OF ENTOMOLOGY.

(Mr. B. A. R. Gater.)

A considerable number of specimens, mostly anopheline larvae and imagines, was identified for Health Officers, private practitioners and others, and a number of short reports was issued. Particulars of these are given below.

Temperatures and humidities were regularly taken in the insectarium and are included in this report for permanent record. They will be found table XXVIII.

| | |
|---|---|
| Reports issued ... ... ... ... ... ... ... | 262 |
| Reports, involving special investigation, issued ... ... | 2 |
| Specimens identified for Health Officers ... ... ... | 1,720 |
| Specimens identified for private practitioners and others ... | 670 |

Table XXVIII.

Temperatures and Humidities in the Insectarium.

| Month. | Temperature, °F. | | | | Relative Humidity. | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean. | | Max. | Min. | Mean. | | | Max. | Min. |
| | Max. | Min. | | | 8 A.M. | Noon. | 4 P.M. | | |
| January ... ... ... | 85.8 | 77.3 | 90.5 | 71.3 | 81.4 | 59.6 | 61.5 | 90.5 | 43.4 |
| February ... ... | 85.9 | 77.6 | 90.7 | 72.0 | 80.8 | 59.9 | 60.6 | 90.5 | 46.6 |
| March ... ... ... | 86.8 | 77.7 | 91.2 | 73.0 | 82.1 | 61.8 | 64.8 | 90.5 | 46.6 |
| April ... ... ... | 86.3 | 78.2 | 90.6 | 73.2 | 83.8 | 64.8 | 71.3 | 90.5 | 53.1 |
| May ... ... ... | 86.3 | 78.8 | 90.0 | 74.0 | 82.4 | 66.3 | 69.2 | 90.5 | 61.0 |
| June ... ... ... | 85.3 | 77.5 | 91.0 | 72.5 | 83.6 | 66.4 | 70.9 | 90.5 | 55.2 |
| July ... ... ... | 85.7 | 77.6 | 89.5 | 70.5 | 81.6 | 65.8 | 66.8 | 90.5 | 51.7 |
| August ... ... ... | 86.6 | 78.1 | 91.0 | 72.3 | 79.3 | 62.4 | 61.2 | 87.5 | 51.4 |
| September ... ... | 84.6 | 77.3 | 89.2 | 73.0 | 82.5 | 68.0 | 72.3 | 90.5 | 53.4 |
| October ... ... ... | 84.9 | 77.2 | 89.5 | 72.5 | 83.6 | 66.3 | 71.3 | 90.5 | 53.1 |
| November ... ... | 84.3 | 77.4 | 88.5 | 74.5 | 86.4 | 70.4 | 73.9 | 90.5 | 53.1 |
| December ... ... | 86.0 | 77.8 | 89.9 | 72.2 | 82.1 | 61.2 | 66.6 | 90.5 | 53.1 |

## ACKNOWLEDGMENTS.

It is desired to acknowledge indebtedness to the following lady and gentlemen for valuable help during the course of investigations:

To the Malaria Advisory Board for providing funds for carrying out the trapping experiments; to the Chief Health Officer for the assistance and for providing extra staff, and to the Health Officers in the Federated Malay States for collecting and forwarding adults and larvae of *A. fuliginosus*, *A. philippinensis* and other specimens; to Drs. C. C. B. Gilmour and J. W. Scharff, Prof. W. A. Young and Dr. Enid Robertson for specimens and information, to Dr. Guy A. K. Marshall, c.m.g., f.r.s., Prof. G. H. F. Nuttall, f.r.s., Prof. G. F. Ferris, Dr. H. E. Ewing, Messrs. F. W. Edwards, C. Warburton and F. F. Laidlaw for help in identification; to Dr. J. Hamlyn Harris and Messrs. M. O. T. Iyengar and Frank H. Taylor for specimens and information; to Messrs. C. Boden Kloss, F. N. Chasen and H. M. Pendlebury for help and access to specimens and literature in the museums; to Messrs. W. N. C. Belgrave, J. H. Dennett, N. C. E. Miller and T. D. Marsh for help, especially in connection with the experiments at Serdang; to Dr. W. T. Quaife for help in conducting the trapping experiments and in many other ways, to Dr. C. Manalang for information; and to the Managers of Elmina Estate and Mount Estate for providing facilities for carrying out investigations on their respective estates.

## V.—STAFF CHANGES.

Dr. A. Neave Kingsbury returned from leave and resumed duty as Director on 4th March, 1929.

Dr. G. V. Allen, Bacteriologist, acted as Director until 3rd March, and, on 22nd June, proceeded to Singapore to act as Principal, King Edward VII College of Medicine.

Dr. P. H. Martin, Pathologist I, was appointed to act as Bacteriologist on 23rd June.

Mr. J. Shelton, Chemist, returned from leave on 11th January, and was seconded for duty in the Chemical Division, Trade and Customs Department on 1st September, 1929.

Dr. R. T. B. Green was appointed Malaria Research Officer I on 1st January, and proceeded on leave on 27th September.

Dr. R. Lewthwaite, Research Student, was appointed Pathologist II on 1st January. He has acted as Pathologist I from 24th June.

Dr. L. Anigstein, of the State Institute of Hygiene, Warsaw, was appointed Research Student, and reported for duty on 16th May.

Dr. H. O. Hopkins, Malaria Research Officer II, was appointed Assistant Bacteriologist, Singapore, and proceeded to Penang on 21st July, to act as Government Pathologist.

Dr. C. Russell Amies, Medical Officer, attached to the Institute, was appointed Malaria Research Officer II on 22nd July, and acted as Malaria Research Officer I from 28th September.

Dr. H. M. Nevin, Medical Officer, was seconded for duty at this Institute on 26th August.

Dr. F. E. Byron, Chemist, proceeded on leave on 12th June.

Mr. K. Kanagarayer, Assistant Surgeon, was appointed to act as Assistant Bacteriologist on 21st August.

Mr. R. Mailvaganam, Chief Clerk, proceeded on leave on 14th February, and reported his return to duty on 25th June.

## VI.—PUBLICATIONS.

### BULLETINS FROM THE INSTITUTE FOR MEDICAL RESEARCH, 1929.

No. 1.—"Pancreatic Efficiency Tests in Malaria," by H. O. Hopkins.

No. 2.—"A Summary of Records of Anopheline Breeding Places in Malaya," by B. A. R. Gater and P. D. Rajamoney.

No. 3.—(i) "The Treatment of 'Crescent Carriers' with Plasmosquine Compound."
(ii) "The Treatment of Quartan Malaria with Plasmoquine."
(iii) "The Treatment of Malaria with Dimeplasmin," by Richard Green.

No. 4.—"The Rubino Reaction in Leprosy," by C. Russell Amies.

No. 5.—"Observations on Some Factors Influencing the Infectivity of Malarial Gamete Carriers in Malaya to Anopheles Maculatus," by Richard Green.

## OTHER PAPERS.

1. "The Etiology of the Tsutsugamushi Disease and Tropical Typhus in the Federated Malay States," Part II by William Fletcher, J. E. Lesslar, and Raymond Lewthwaite. *Trans. Roy. Soc. Trop. Med. and Hyg.* XXIII. p. 57.
2. "Observations on Cases of Keratomalacia," by P. H. Martin. *Malayan Med. Jl.* IV. p. 103.
3. "Some Observations on the Leprous Reaction," by R. Green. *Trans. Roy. Soc. Trop. Med. and Hyg.* XXII. p. 367.
4. "The Treatment of Leprosy with Solganal," by C. Russell Amies. *Trans. Roy. Soc. Trop. Med. and Hyg.* XXIII. p. 309.
5. "The Wassermann and Kahn Reactions in Leprosy," by C. Russell Amies. *Malayan Med. Jl.* IV p. 129.
6. "The Relative Incidence of Albuminuria Among Cases of Benign Tertian, Sub-Tertian and Quartan Malaria," by R. Green. *Malayan Med. Jl.* IV. p. 63.
7. "Notes on the Detection in the Urine of Some Drugs used in the Treatment of Malaria," by Richard Green. *Indian Med. Gaz.* LXIV. p. 614.
8. "The Relationship of the Blood Groups to Immunity from Malaria and to Gametocyte Formation," by Richard Green. *Trans. Roy. Soc. Trop. Med. and Hyg.* XXIII. p. 161.
9. "The Treatment of Malaria with Dimeplasmin," by Richard Green. *Lancet* 1929, I p. 1,137.
10. "An Improved Method of Mounting Mosquito Larvae," by B. A. R. Gater. *Bull. Ent. Research* XIX. p. 367.
11. "Notes on handling *A. maculatus* Theo. for Experimental Purposes," by B. A. R. Gater and P. D. Rajamoney. *Malayan Med. Jour.* IV. p. 88.
12. "Cutaneous Blastomycosis," by K. Kanagarayer. *Malayan Med. Jour.* IV. p. 111.

A. NEAVE KINGSBURY,
*Director, Institute for Medical Research,*
*F.M.S., Kuala Lumpur.*

## Appendix II.

# REPORT OF THE REGISTRAR-GENERAL OF BIRTHS AND DEATHS, FEDERATED MALAY STATES, FOR THE YEAR 1929.

The last census was made in 1921. The figures for the total population, for the different races comprised in it, and for the towns, have been estimated for succeeding years including the year under review, on a basis of arithmetical increase. Since immigration and emigration have a greater influence than births and deaths on the population of the Federated Malay States, and since full statistics of immigrants and emigrants are not available, the estimates of the population for 1929 can only be accepted as a rough approximation to the actual figures.

Registration of births and deaths is compulsory throughout the country, and the total number of births and deaths can be accepted as approximately correct. The calculated birth and death-râtes are, however, liable to considerable error on account of the uncertainty in the population figures.

The recorded causes of deaths must be accepted with reserve. In the four large towns every uncertified death is investigated by a medically qualified officer; but in the rural districts the cause of death is recorded only by a Police Officer.

The records of deaths in towns have been corrected by the exclusions of deaths of individuals with less than three months residence in the town. Even with this correction it is probable that the towns have been debited with more than their proper share of deaths, on account of the drift of sick towards the towns.

The general death-rate for the four States was 26.37 per mille as against 29.63 per mille for the whole of the Federated Malay States for 1928.

The number of deaths attributable to fevers (most of them probably malaria) was 16,968 or 41.18 of the total. Last year the percentage was 44.13. The figures for malaria show a distinct improvement over those for the last two years.

Dysentery and diarrhœa accounted for 5.38 per cent. of total deaths, pulmonary tuberculosis for 5.05 per cent., pneumonia for 7.72 per cent., and convulsions for 12.83 per cent.

### POPULATION.

The total population of the country during 1929 was estimated to be :

| | |
|---|---|
| Perak | 685,680 |
| Selangor | 489,262 |
| Negri Sembilan | 218,826 |
| Pahang | 168,633 |
| Total | 1,562,401 |

The composition by races, calculated on the basis of the census year, was estimated to be :

| States. | Europeans and Americans. | Eurasians. | Malays and other natives of the Archipelago. | Chinese. | Indians. | Others. |
|---|---|---|---|---|---|---|
| Perak | 2,586 | 1,081 | 272,206 | 230,675 | 177,170 | 1,962 |
| Selangor | 3,390 | 1,877 | 113,925 | 187,005 | 180,790 | 2,275 |
| Negri Sembilan | 1,299 | 564 | 84,168 | 85,242 | 46,371 | 1,182 |
| Pahang | 394 | 142 | 114,756 | 42,203 | 10,409 | 729 |
| Total F.M.S. | 7,669 | 3,664 | 585,055 | 545,125 | 414,740 | 6,148 |

Population of the four principal towns :

| Town. | Estimated population. |
|---|---|
| Kuala Lumpur | 108,242 |
| Ipoh | 47,461 |
| Taiping | 22,398 |
| Seremban | 24,394 |

## BIRTHS AND DEATHS.

The total number of births registered was 54,172, and the estimated birth-rate 34.67.

Corresponding figures for the last ten years are as under :

| Year. | Total births. | Birth-rate. |
|---|---|---|
| 1920 ... ... ... ... ... ... | 36,556 ... | 27.05 |
| 1921 ... ... ... ... ... ... | 36,294 ... | 27.81 |
| 1922 ... ... ... ... ... ... | 34,906 ... | 25.65 |
| 1923 ... ... ... ... ... ... | 35,653 ... | 25.66 |
| 1924 ... ... ... ... ... ... | 39,512 ... | 27.86 |
| 1925 ... ... ... ... ... ... | 41,818 ... | 28.89 |
| 1926 ... ... ... ... ... ... | 39,834 ... | 30.28* |
| 1927 ... ... ... ... ... ... | 48,013 ... | 31.91 |
| 1928 ... ... ... ... ... ... | 52,771 ... | 34.41 |
| 1929 ... ... ... ... ... ... | 54,172 ... | 34.67 |

* Excluding Pahang.

## SUMMARY OF BIRTHS AND DEATHS FOR THE YEAR 1929.

### BIRTHS.

| States. | Europeans and Americans. | Eurasians. | Malays and other races of the Archipelago. | Chinese. | Indians. | Others. | Total. | Rate per mille of population. |
|---|---|---|---|---|---|---|---|---|
| Perak ... ... | 54 | 32 | 9,458 | 9,068 | 4,997 | 80 | 23,689 | 34.55 |
| Selangor ... | 83 | 64 | 4,448 | 8,156 | 5,861 | 22 | 18,634 | 38.09 |
| Negri Sembilan | 4 | 27 | 3,113 | 2,294 | 1,306 | 6 | 6,750 | 30.85 |
| Pahang ... | 3 | 3 | 3,184 | 1,588 | 319 | 2 | 5,099 | 30.23 |
| Total, F.M.S. | 144 | 126 | 20,203 | 21,106 | 12,483 | 110 | 54,172 | 34.67 |

### DEATHS.

| States. | Europeans and Americans. | Eurasians. | Malays and other races of the Archipelago. | Chinese. | Indians. | Others. | Total. | Rate per mille of population. |
|---|---|---|---|---|---|---|---|---|
| Perak ... ... | 20 | 8 | 5,738 | 7,430 | 4,371 | 60 | 17,627 | 25.71 |
| Selangor ... | 14 | 28 | 2,449 | 5,785 | 4,825 | 13 | 13,114 | 26.80 |
| Negri Sembilan | 5 | 8 | 2,032 | 2,127 | 1,771 | 7 | 5,950 | 27.19 |
| Pahang ... | 3 | 1 | 2,790 | 1,233 | 483 | 2 | 4,512 | 26.75 |
| Total, F.M.S. | 42 | 45 | 13,009 | 16,575 | 11,450 | 82 | 41,203 | 26.37 |

## BIRTHS AND BIRTH-RATES ACCORDING TO RACES DURING THE LAST TEN YEARS.

| Year. | Europeans and Americans. | | Eurasians. | | Malays and other natives of the Archipelago. | | Chinese. | | Indians. | | Others. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. |
| 1920 ... | 145 | 29.71 | 102 | 28.06 | 18,968 | 36.81 | 8,279 | 15.06 | 8,940 | 32.81 | 122 | 19.51 |
| 1921 ... | 186 | 32.41 | 109 | 34.04 | 19,772 | 40.59 | 8,483 | 17.12 | 7,585 | 24.63 | 159 | 29.71 |
| 1922 ... | 153 | 25.56 | 102 | 31.15 | 18,896 | 36.19 | 8,723 | 17.37 | 6,931 | 21.54 | 101 | 18.28 |
| 1923 ... | 126 | 20.24 | 102 | 30.64 | 19,250 | 36.25 | 9,084 | 17.87 | 7,023 | 20.96 | 68 | 12.11 |
| 1924 ... | 112 | 17.32 | 126 | 37.22 | 20,221 | 37.44 | 10,929 | 21.24 | 8,054 | 23.12 | 70 | 12.27 |
| 1925 ... | 139 | 20.72 | 101 | 29.37 | 20,056 | 36.53 | 12,291 | 23.61 | 9,163 | 25.34 | 68 | 11.74 |
| 1926 * ... | 131 | 19.86 | 127 | 37.76 | 17,522 | 39.12 | 12,973 | 26.61 | 9,010 | 24.68 | 71 | 13.67 |
| 1927 ... | 119 | 16.56 | 106 | 29.85 | 20,814 | 36.71 | 16,652 | 31.25 | 10,244 | 26.39 | 78 | 13.05 |
| 1928 ... | 148 | 19.92 | 127 | 35.17 | 22,042 | 38.26 | 19,067 | 35.38 | 11,315 | 28.18 | 72 | 11.86 |
| 1929 ... | 144 | 18.78 | 126 | 34.39 | 20,203 | 34.53 | 21,106 | 38.72 | 12,483 | 30.10 | 110 | 17.89 |

* Excluding Pahang.

This is the first time that the number of births is greater and birth-rate higher for the Chinese than the Malays, the birth-rate of the latter being lower than in any of the past ten years.

## BIRTHS AND BIRTH-RATES BY STATES FOR THE LAST TEN YEARS.

| Year. | Perak. | | Selangor. | | Negri Sembilan. | | Pahang. | |
|---|---|---|---|---|---|---|---|---|
| | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. |
| 1920 ... ... | 17,000 | 26.61 | 10,865 | 26.91 | 4,809 | 30.03 | 3,882 | 26.06 |
| 1921 ... ... | 16,521 | 28.01 | 10,364 | 25.84 | 5,042 | 28.19 | 4,367 | 32.33 |
| 1922 ... ... | 16,278 | 26.59 | 9,795 | 23.64 | 4,546 | 24.60 | 4,287 | 28.68 |
| 1923 ... ... | 16,274 | 26.14 | 10,120 | 23.81 | 4,893 | 25.79 | 4,366 | 28.68 |
| 1924 ... ... | 17,482 | 27.61 | 11,868 | 27.23 | 5,298 | 27.33 | 4,864 | 31.39 |
| 1925 ... ... | 17,868 | 27.76 | 13,256 | 29.69 | 5,522 | 27.69 | 5,172 | 32.80 |
| 1926 ... ... | 20,095 | 30.72 | 13,914 | 30.44 | 5,825 | 28.51 | No figures | |
| 1927 ... ... | 20,333 | 30.59 | 15,892 | 33.97 | 6,306 | 30.16 | 5,482 | 33.60 |
| 1928 ... ... | 22,851 | 33.84 | 17,961 | 37.53 | 6,823 | 31.89 | 5,136 | 30.96 |
| 1929 ... ... | 23,689 | 34.55 | 18,634 | 38.09 | 6,750 | 30.85 | 5,099 | 30.23 |

## BIRTHS AND BIRTH-RATES BY STATES AND RACES.

| State. | Europeans and Americans. | | Eurasians. | | Malays and other natives of the Archipelago. | | Chinese. | | Indians. | | Others. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. |
| Perak ... ... ... | 54 | 20.88 | 32 | 29.60 | 9,458 | 34.75 | 9,068 | 39.31 | 4,997 | 28.20 | 80 | 40.77 |
| Selangor ... ... ... | 83 | 24.48 | 64 | 34.10 | 4,448 | 39.04 | 8,156 | 43.61 | 5,861 | 32.42 | 22 | 9.67 |
| Negri Sembilan ... ... | 4 | 3.08 | 27 | 47.87 | 3,113 | 36.99 | 2,294 | 26.91 | 1,306 | 28.16 | 6 | 5.08 |
| Pahang ... ... ... | 3 | 7.61 | 3 | 21.12 | 3,184 | 27.74 | 1,588 | 37.62 | 319 | 30.64 | 2 | 2.74 |

## BIRTHS AND BIRTH-RATES IN THE FOUR PRINCIPAL TOWNS FOR THE LAST EIGHT YEARS.

| Year. | Kuala Lumpur. | | Ipoh. | | Taiping. | | Seremban. | |
|---|---|---|---|---|---|---|---|---|
| | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. | Births. | Birth-rate. |
| 1922 ... | 1,813 | 21.46 | 974 | 25.04 | 721 | 33.86 | 461 | 25.05 |
| 1923 ... | 2,001 | 22.74 | 904 | 22.38 | 735 | 34.24 | 456 | 23.74 |
| 1924 ... | 2,604 | 28.50 | 1,072 | 26.12 | 926 | 42.84 | 507 | 25.26 |
| 1925 ... | 2,945 | 31.08 | 844 | 19.94 | 990 | 45.45 | 623 | 29.75 |
| 1926 ... | 3,645 | 37.15 | 1,364 | 31.24 | 1,107 | 50.46 | 664 | 30.40 |
| 1927 ... | 4,840 | 47.69 | 1,650 | 36.74 | 1,119 | 50.65 | 740 | 32.65 |
| 1928 ... | 5,717 | 54.61 | 1,867 | 40.28 | 1,170 | 52.58 | 857 | 36.37 |
| 1929 ... | 6,364 | 58.79 | 2,448 | 51.58 | 1,211 | 54.07 | 884 | 36.24 |

## DEATHS AND DEATH-RATES.

The total number of deaths registered was 41,203 and the estimated death-rate 26.37.

Corresponding figures for the last ten years are as under:

| Year. | Population. | Deaths. | Rate per mille. |
|---|---|---|---|
| 1920 ... ... ... | 1,351,541 ... | 43,705 ... | 32.34 |
| 1921 ... ... ... | 1,304,825 ... | 38,077 ... | 29.18 |
| 1922 ... ... ... | 1,360,876 ... | 35,028 ... | 25.74 |
| 1923 ... ... ... | 1,389,667 ... | 33,914 ... | 24.40 |
| 1924 ... ... ... | 1,418,455 ... | 33,585 ... | 23.68 |
| 1925 ... ... ... | 1,447,243 ... | 34,153 ... | 23.60 |
| 1926 ... ... ... | 1,315,606 ... | 38,445 ... | 29.22* |
| 1927 ... ... ... | 1,504,823 ... | 48,323 ... | 32.11 |
| 1928 ... ... ... | 1,533,612 ... | 45,437 ... | 29.63 |
| 1929 ... ... ... | 1,562,401 ... | 41,203 ... | 26.37 |

* Excluding Pahang.

The death-rate shows a satisfactory decrease of 3.26 per mille compared with last year.

## DEATHS AND DEATH-RATES ACCORDING TO RACES FOR THE LAST TEN YEARS.

| Year. | Europeans and Americans. | | Eurasians. | | Malays and other natives of the Archipelago. | | Chinese. | | Indians. | | Others. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. |
| 1920 ... ... | 35 | 7.17 | 49 | 13.48 | 14,685 | 28.49 | 15,565 | 28.35 | 13,192 | 48.41 | 179 | 28.69 |
| 1921 ... ... | 34 | 5.92 | 64 | 2.00 | 13,019 | 26.73 | 13,306 | 26.85 | 11,505 | 37.35 | 149 | 27.89 |
| 1922 ... ... | 39 | 6.52 | 44 | 13.41 | 12,706 | 24.34 | 12,374 | 24.64 | 9,741 | 30.27 | 124 | 22.45 |
| 1923 ... ... | 34 | 5.46 | 42 | 12.62 | 13,111 | 24.69 | 12,016 | 23.64 | 8,635 | 25.77 | 76 | 13.54 |
| 1924 ... ... | 36 | 5.57 | 45 | 13.29 | 13,185 | 24.41 | 12,105 | 23.53 | 8,057 | 23.13 | 157 | 27.53 |
| 1925 ... ... | 27 | 4.03 | 36 | 10.47 | 12,541 | 22.82 | 12,560 | 24.13 | 8,863 | 24.51 | 126 | 21.75 |
| 1926 ... ... | 36 | 5 46 | 46 | 13.68 | 11,657 | 26.03 | 14,730 | 30.22 | 11,920 | 32.64 | 56 | 10.78 |
| 1927 ... ... | 35 | 4.87 | 53 | 14.93 | 15,283 | 26.95 | 18,506 | 34.73 | 14,372 | 37.02 | 74 | 12.38 |
| 1928 ... ... | 41 | 5.52 | 48 | 13.29 | 14,405 | 25.00 | 16,909 | 31.37 | 13,948 | 34.74 | 86 | 14.16 |
| 1929 ... ... | 42 | 5.48 | 45 | 12.28 | 13,009 | 22.24 | 16,575 | 30.40 | 11,450 | 27.61 | 82 | 13.34 |

## DEATHS AND DEATH-RATES BY STATES FOR THE LAST TEN YEARS.

| Year. | Perak. | | Selangor. | | Negri Sembilan. | | Pahang. | |
|---|---|---|---|---|---|---|---|---|
| | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. |
| 1920 ... | 19,188 | 30.03 | 13,529 | 33.51 | 6,792 | 42.42 | 4,196 | 28.16 |
| 1921 ... | 16,328 | 27.68 | 11,888 | 29.64 | 5,714 | 31.94 | 4,147 | 30.70 |
| 1922 ... | 15,871 | 25.93 | 10,487 | 25.31 | 4,917 | 26.60 | 3,753 | 25.11 |
| 1923 ... | 15,613 | 25.07 | 9,933 | 23.37 | 4,679 | 24.67 | 3,689 | 24.24 |
| 1924 ... | 14,768 | 23.32 | 9,371 | 21.50 | 4,883 | 25.10 | 4,573 | 29.45 |
| 1925 ... | 15,359 | 23.86 | 10,159 | 22.75 | 4,688 | 23.51 | 3,947 | 25.03 |
| 1926 ... | 18,506 | 28.29 | 13,390 | 29.29 | 6,549 | 32.06 | No figures | |
| 1927 ... | 19,738 | 29.70 | 14,117 | 30.17 | 7,400 | 35.39 | 7,068 | 43.32 |
| 1928 ... | 18,256 | 27.04 | 13,893 | 29.03 | 7,050 | 32.95 | 6,238 | 37.60 |
| 1929 ... | 17,627 | 25.71 | 13,114 | 26.80 | 5,950 | 27.19 | 4,512 | 26.75 |

## DEATHS AND DEATH-RATES BY STATES AND RACES.

| State. | Europeans and Americans. | | Eurasians. | | Malays and other natives of the Archipelago. | | Chinese. | | Indians. | | Others. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. | Deaths. | Death-rate. |
| Perak ... ... ... | 20 | 7.73 | 8 | 7.40 | 5,738 | 21.08 | 7,430 | 32.21 | 4,371 | 24.67 | 60 | 30.58 |
| Selangor ... ... ... | 14 | 4.13 | 28 | 14.92 | 2,449 | 21.50 | 5,785 | 30.94 | 4,825 | 26.69 | 13 | 5.71 |
| Negri Sembilan ... ... | 5 | 3.85 | 8 | 14.18 | 2,032 | 24.14 | 2,127 | 24.95 | 1,771 | 38.19 | 7 | 5.92 |
| Pahang ... ... ... | 3 | 7.61 | 1 | 7.04 | 2,790 | 24.31 | 1,233 | 29.21 | 483 | 46.40 | 2 | 2.74 |

## DEATHS AND DEATH-RATES IN THE FOUR PRINCIPAL TOWNS FOR THE LAST TEN YEARS.

| Year. | Kuala Lumpur. | | | Ipoh. | | | Taiping. | | | Seremban. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population. | Deaths. | Death-rate. | Population. | Deaths. | Death-rate. | Population. | Deaths. | Death-rate. | Population. | Deaths. | Death-rate. |
| 1920 ... | 67,930 | 2,038 | 30.00 | 34,357 | 778 | 22.64 | 25,434 | 1,015 | 39.90 | 15,006 | 511 | 34.05 |
| 1921 ... | 81,197 | 2,194 | 27.02 | 37,194 | 754 | 20.38 | 21,178 | 1,060 | 50.05 | 17,479 | 632 | 36.16 |
| 1922 ... | 84,476 | 1,803 | 21.36 | 38,895 | 847 | 21.78 | 21,296 | 747 | 35.08 | 13,398 | 514 | 27.93 |
| 1923 ... | 88,009 | 1,689 | 19.19 | 40,399 | 813 | 20.12 | 21,462 | 718 | 33.45 | 19,210 | 476 | 24.78 |
| 1924 ... | 91,381 | 1,651 | 16.74 | 41,047 | 570 | 13.89 | 21,616 | 733 | 33.91 | 20,074 | 348 | 17.34 |
| 1925 ... | 94,753 | 1,451 | 15.31 | 42,334 | 592 | 13.98 | 21,780 | 634 | 29.11 | 20,938 | 372 | 17.77 |
| 1926 ... | 98,125 | 2,062 | 21.01 | 43,662 | 580 | 13.28 | 21,936 | 758 | 34.55 | 21,838 | 533 | 24.41 |
| 1927 ... | 101,497 | 2,380 | 23.47 | 44,910 | 645 | 14.36 | 22,093 | 1,011 | 45.76 | 22,666 | 582 | 25.68 |
| 1928 ... | 104,870 | 2,155 | 20.55 | 46,231 | 621 | 13.43 | 22,249 | 803 | 36.09 | 23,566 | 652 | 27.62 |
| 1929 ... | 108,242 | 2,016 | 18.62 | 47,461 | 745 | 15.69 | 22,398 | 660 | 29.47 | 24,394 | 495 | 20.29 |

## INFANTILE MORTALITY.

Table showing infantile deaths, and death-rate per 1,000 births for the last ten years :

| Year. | Deaths of children under one year of age. | Death-rate per 1,000 births. |
|---|---|---|
| 1920 | 6,910 | 189.03 |
| 1921 | 6,646 | 183.12 |
| 1922 | 5,963 | 170.83 |
| 1923 | 6,420 | 180.07 |
| 1924 | 7,133 | 180.53 |
| 1925 | 7,409 | 177.17 |
| *1926 | 7,718 | 193.75 |
| 1927 | 9,752 | 203.11 |
| 1928 | 9,610 | 182.11 |
| 1929 | 9,618 | 177.55 |

* Excluding Pahang.

## TABLE SHOWING INFANTILE DEATHS AND DEATH-RATES BY STATES FOR THE LAST TEN YEARS.

| Year. | Perak. | | Selangor. | | Negri Sembilan. | | Pahang. | |
|---|---|---|---|---|---|---|---|---|
| | Deaths of children under 1 year of age. | Death-rate per 1,000 births. | Deaths of children under 1 year of age. | Death-rate per 1,000 births. | Deaths of children under 1 year of age. | Death-rate per 1,000 births. | Deaths of children under 1 year of age. | Death-rate per 1,000 births. |
| 1920 ... ... | 3,064 | 180.13 | 2,112 | 194.38 | 945 | 196.50 | 789 | 203.24 |
| 1921 ... ... | 2,652 | 160.51 | 2,095 | 202.14 | 1,010 | 200.32 | 889 | 203.57 |
| 1922 ... ... | 2,474 | 151.98 | 1,852 | 189.08 | 841 | 185.00 | 796 | 185.68 |
| 1923 ... ... | 2,770 | 170.21 | 1,907 | 188.44 | 885 | 180.87 | 858 | 196.52 |
| 1924 ... ... | 2,767 | 158.28 | 2,040 | 171.89 | 1,091 | 205.93 | 1,235 | 253.91 |
| 1925 ... . . | 2,964 | 165.88 | 2,359 | 177.96 | 1,108 | 200.65 | 978 | 189.10 |
| 1926 ... ... | 3,459 | 172.13 | 2,888 | 207.56 | 1,371 | 235.36 | No figures | |
| 1927 ... ... | 3,687 | 181.33 | 3,018 | 189.91 | 1,448 | 229.62 | 1,599 | 291.68 |
| 1928 ... ... | 3,691 | 161.52 | 3,041 | 169.31 | 1,443 | 211.49 | 1,435 | 279.40 |
| 1929 ... ... | 3,672 | 155.01 | 3,333 | 178.87 | 1,366 | 202.37 | 1,247 | 244.56 |

## TABLE SHOWING INFANTILE DEATHS AND DEATH-RATES OF THE FOUR PRINCIPAL TOWNS FOR THE LAST EIGHT YEARS.

| Year. | Kuala Lumpur. | | | Ipoh. | | | Taiping. | | | Seremban. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Births. | Deaths under 1 year. | Death-rate per 1,000 births. | Births. | Deaths under 1 year. | Death-rate per 1,000 births. | Births. | Deaths under 1 year. | Death-rate per 1,000 births. | Births. | Deaths under 1 year. | Death-rate per 1,000 births. |
| 1922 ... | 1,813 | 339 | 186.43 | 974 | 152 | 156.05 | 721 | 195 | 270.46 | 461 | 126 | 273.31 |
| 1923 ... | 2,001 | 373 | 186.41 | 904 | 119 | 131.64 | 735 | 148 | 201.36 | 456 | 140 | 307.02 |
| 1924 ... | 2,604 | 442 | 169.74 | 1,072 | 126 | 117.54 | 926 | 171 | 184.67 | 507 | 103 | 203.16 |
| 1925 ... | 2,945 | 428 | 145.33 | 844 | 120 | 142.18 | 990 | 145 | 146.46 | 623 | 101 | 162.12 |
| 1926 ... | 3,645 | 469 | 128.67 | 1,364 | 131 | 96.04 | 1,107 | 172 | 155.37 | 664 | 139 | 209.33 |
| 1927 ... | 4,840 | 507 | 104.75 | 1,650 | 140 | 84.85 | 1,119 | 160 | 142.98 | 740 | 109 | 147.30 |
| 1928 ... | 5,717 | 812 | 97.25 | 1,867 | 151 | 80.88 | 1,170 | 207 | 176.90 | 857 | 263 | 164.53 |
| 1929 ... | 6,364 | 555 | 87.21 | 2,448 | 149 | 60.87 | 1,211 | 142 | 117.26 | 884 | 129 | 145.93 |

Table showing deaths due to certain diseases which have accounted for more than 1,000 deaths.

| Diseases. | No. of deaths. | Rate per mille. |
|---|---|---|
| Malaria ... ... ... ... ... ... | 16,968 ... | 10.86 |
| Convulsions ... ... ... ... ... | 5,297 ... | 3.39 |
| Pneumonia and other Respiratory Diseases ... | 3,182 ... | 2.04 |
| Dysentery and diarrhoea ... ... ... | 2,194 ... | 1.40 |
| Phthisis (pulmonary tuberculosis) ... ... | 2,080 ... | 1.33 |

## TABLE SHOWING DEATHS BY AGES AND STATES.

| State. | Children under 1 year. | Persons between 20-40. | Persons over 60. | Persons of other ages. | Total No. of deaths. |
|---|---|---|---|---|---|
| Perak ... ... ... | 3,672 ... | 4,138 ... | 2,314 ... | 7,503 ... | 17,627 |
| Selangor ... ... | 3,333 ... | 3,528 ... | 1,034 ... | 5,219 ... | 13,114 |
| Negri Sembilan ... | 1,366 ... | 1,721 ... | 547 ... | 2,316 ... | 5,950 |
| Pahang ... ... | 1,247 ... | 1,148 ... | 319 ... | 1,798 ... | 4,512 |
| Total, F.M.S. ... | 9,618 ... | 10,535 ... | 4,214 ... | 16,836 ... | 41,203 |

A. K. COSGRAVE,
*Acting Registrar-General of Births and Deaths,*
*Federated Malay States.*

## APPENDIX III.

# REPORT OF THE CHIEF MEDICAL OFFICER, SOCIAL HYGIENE, FEDERATED MALAY STATES, FOR THE YEAR 1929.

The work of educating the general public as to the dangers of venereal disease has made further progress by means of numerous lectures and other forms of propaganda. Forty thousand eight hundred and two patients were treated for venereal disease during 1929. This is an increase of 15 per cent. over 1928. The average number of arsenic and bismuth injections per case of syphilis was 3.9. This is a slight improvement on former years but is still far too low. Attendance of women patients shows a satisfactory rise which is attributable to the presence of specially trained nurses at the main Clinics. Venereal disease treatment is available at 59 centres in the Federated Malay States. During the year 19 Dressers received special training at Kuala Lumpur for work in the out-station hospitals and dispensaries.

The following table shows the nationality, diseases and numbers treated throughout the Federated Malay States for the year 1928 and 1929:

| Nationality. | Total number. |  | Syphilis. |  | Gonorrhoea. |  | Soft sore. |  |
|---|---|---|---|---|---|---|---|---|
|  | 1928. | 1929. | 1928. | 1929. | 1928. | 1929. | 1928. | 1929. |
| Chinese... ... | 19,556 | 22,615 | 13,446 | 14,709 | 4,978 | 6,080 | 1,132 | 1,826 |
| Tamils ... ... | 9,526 | 11,707 | 5,134 | 6,536 | 3,480 | 3,911 | 912 | 1,260 |
| Malays ... ... | 3,343 | 3,545 | 1,914 | 2,281 | 1,279 | 1,110 | 150 | 154 |
| Sikhs ... ... | 1,472 | 1,545 | 845 | 888 | 487 | 538 | 140 | 119 |
| Eurasians ... | 197 | 186 | 60 | 65 | 126 | 106 | 11 | 15 |
| Europeans ... | 457 | 489 | 81 | 75 | 327 | 372 | 49 | 42 |
| Others ... ... | 825 | 715 | 455 | 421 | 308 | 249 | 62 | 45 |
| Total ... | 35,366 | 40,802 | 21,935 | 24,975 | 10,985 | 12,366 | 2,456 | 3,461 |

From the above table it would appear that the Asiatic suffered more from syphilis and the European more from gonorrhoea—the incidence ratio being two to one and one to six respectively. This difference is more apparent than real. The European infection ratio agrees closely with that experienced in England and is probably an accurate incidence rate. The Asiatic infection rate is explained by the disinclination of the lower classes to regard gonorrhoea as a serious disease and consequently to seek treatment. The necessary prolonged treatment for gonorrhoea is also contrasted unfavourably with the obvious and rapid improvement shewn with anti-syphilitic treatment and is therefore less acceptable to those so infected.

During the year 54,000 injections of arsenical compounds were given, together with 45,000 injections of bismuth compounds.

The following table shows the numbers treated in each State during the year 1928 and 1929:

| State. | 1928. | 1929. |
|---|---|---|
| Perak ... ... ... ... ... ... | 11,262 | 15,129 |
| Selangor ... ... ... ... ... | 15,046 | 16,299 |
| Negri Sembilan ... ... ... ... | 7,587 | 8,048 |
| Pahang ... ... ... ... ... | 1,471 | 1,326 |
| Total ... | 35,366 | 40,802 |

Graph 1 represents the progress from 1925.

A report on Anti-Venereal Disease work falls, naturally, under two headings:

A.—Propaganda and Education.

B.—Treatment Centres and Treatment.

## A.—PROPAGANDA AND EDUCATION.

1. Lantern Lectures.—Lectures to the English-speaking community have been given as follows :

| | |
|---|---|
| Perak ... ... ... | Ipoh (two), Taiping, Tapah, Bagan Serai. |
| Selangor ... ... ... | Kuala Lumpur (two), Klang, Serendah, Rawang, Kuala Kubu. |
| Negri Sembilan ... ... | Port Dickson, Kuala Pilah. |
| Pahang ... ... ... | Bentong, Mentakab, Temerloh. |

The average attendance has been between 80 and 100. A lecture at the Central Workshops, Kuala Lumpur, was attended by 350 people and at Taiping, to the 1/20 Burma Rifles, by over 600.

The non-English-speaking community is reached by a whole-time lecturer appointed by the Committee for Public Health Education. This lecturer has a magic lantern and slides, and tours the whole of the Federated Malay States.

Great help has been received from the District Officers who have assisted in advertising these lectures, and in many cases by presiding.

2. A Social Hygiene Section was on view at the Malayan Agri-Horticultural Exhibition at Taiping and was well attended. I have to thank the British Social Hygiene Society for their very striking posters. The value of these forms of propaganda is undoubted and is reflected in the increased attendance at the local centres.

3. Posters and Pamphlets.—Posters in English, Malay, Chinese, Tamil and Urdu are displayed at all Government hospitals and dispensaries, and pamphlets in these languages are given away.

4. The Venereal Disease Clinics are also propaganda centres and the importance of this side of their work is impressed on the staff. Much good work has been done by inducing infected patients to bring the husband—or the wife—and children for examination. The various Infant Welfare Centres have greatly helped in these cases.

5. In view of the proposed changes in the Enactment regarding brothels, a woman visitor (Almoner) has lately been employed to do propaganda work amongst the prostitutes of Kuala Lumpur. Her work is difficult and at present hampered by suspicion, but it is hoped that her usefulness will increase with time.

## B.—TREATMENT CENTRES AND TREATMENT.

There are 59 treatment centres in the Federated Malay States. They may be classified as follows :

(1) The Venereal Disease Clinics at Taiping, Ipoh, Kuala Lumpur, Klang and Seremban, where the bulk of the work is treatment of venereal disease combined with that of general disease.

All these Clinics have specially trained Assistant Surgeons, Dressers, Nurses and Amahs.

(2) The hospitals where indoor and outdoor treatment is available.

(3) The dispensaries: These provide routine irrigation treatment and are visited weekly by a Medical Officer or Assistant Surgeon for treatment by injection. More than half of the Dressers in charge have been specially trained in the diagnosis and treatment of venereal disease.

## SELANGOR.

### The Venereal Disease Clinic and Town Dispensary, Sultan Street, Kuala Lumpur.

The premises consist of two shop houses, one of which contains the Town Dispensary and Female Clinic, and the other the Male Clinic. Accommodation is barely sufficient and the desired privacy is lacking. Waiting rooms are particularly wanted.

The following table shows the nationality, diseases and numbers treated during the years 1928 and 1929 :

| Nationality. | Total number. | | Syphilis. | | Gonorrhoea. | | Soft sore. | |
|---|---|---|---|---|---|---|---|---|
| | 1928. | 1929. | 1928. | 1929. | 1928. | 1929. | 1928. | 1929. |
| Chinese .. ... | 4,170 | 4,414 | 1,565 | 1,691 | 2,404 | 2,570 | 201 | 253 |
| Tamils ... ... | 919 | 1,057 | 379 | 430 | 432 | 476 | 108 | 151 |
| Malays ... ... | 228 | 318 | 114 | 180 | 101 | 119 | 13 | 19 |
| Sikhs ... ... | 254 | 255 | 125 | 138 | 96 | 89 | 33 | 47 |
| Eurasians ... | 76 | 60 | 21 | 24 | 48 | 28 | 7 | 8 |
| Europeans ... | 291 | 276 | 45 | 34 | 210 | 221 | 36 | 21 |
| Others ... ... | 99 | 95 | 43 | 55 | 48 | 35 | 8 | 5 |
| Total ... | 6,037 | 6,475 | 2,292 | 2,552 | 3,339 | 3,438 | 406 | 485 |

Of the 1929 total, 2,634 were females.

Four hundred and thirty attended for prophylactic treatment as compared with 353 in 1928.

It is for this purpose that the Clinic is kept open from 8 to 10 a.m. on all holidays and Sundays.

The relation between the influence of alcohol at the time of exposure and the incidence of venereal disease is shown, by nationality, below :

| Nationality. | Total infected. | Under Alcohol. |
|---|---|---|
| Chinese ... ... ... ... ... | 2,050 ... | 32 per cent. |
| Tamils ... ... ... ... ... | 955 ... | 40 ,, |
| Malays ... ... ... ... ... | 225 ... | 27 ,, |
| Sikhs ... ... ... ... ... | 231 ... | 55 ,, |
| Eurasians ... ... ... ... ... | 47 ... | 57 ,, |
| Europeans ... ... ... ... | 273 ... | 59 ,, |

I consider these percentages are too high to be true and allowance must be made for the tendency amongst all patients to put the blame for their subsequent troubles on alcohol alone. The racial proportion is similar to that of former years.

### Female Section, Sultan Street Clinic.

Two thousand six hundred and thirty-four patients were treated for venereal disease during the year.

Comparative figures : 1928, 2,541 including 1,668 prostitutes.

1929, 2,634 ,, 1,637 ,,

Disease is shown, by nationality, below:

| Nationality. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| Chinese ... | ... 465 | ... 1,899 | ... — | ... 2,364 |
| Tamils ... | ... 63 | ... 38 | ... 1 | ... 102 |
| Malays ... | ... 82 | ... 11 | ... — | ... 93 |
| Sikhs ... | ... 17 | ... 7 | ... — | ... 24 |
| Eurasians | ... 7 | ... 6 | ... — | ... 13 |
| Europeans | ... — | ... 3 | ... — | ... 3 |
| Others ... | ... 24 | ... 11 | ... — | ... 35 |
| Total ... | 658 | ... 1,975 | ... 1 | ... 2,634 |

Twenty-eight women received ante-natal treatment for syphilis. Twenty-two children were treated for gonorrhoea. Thirty-seven children were treated for syphilis. One thousand six hundred and seventeen women received treatment for other than venereal disease.

A Lady Medical Officer has been available for nine out of the twelve months and the increased attendance is attributable to her presence.

. There is a slight fall in the attendance of prostitutes. This is due to (1) the partial closure of brothels and (2) the consequent suspicion of Government institutions aroused amongst this class of patient. It is probable that a further fall will occur during 1930.

### District Hospital, Kuala Lumpur.

Two forty-bed wards are available for indoor treatment. There is also accommodation for second class patients.

Total treated (in-door and out-door) 1928 = 1,537.
,, ,, ,, 1929 = 1,888.

### The Federal Home for Women and Children, Kuala Lumpur.

During the year 62 girls were admitted suffering from venereal disease—28 with syphilis and 34 with gonorrhoea.

## OTHER CLINICS.

| | | Klang. | Taiping. | Ipoh. | Seremban. |
|---|---|---|---|---|---|
| Numbers treated | 1928 | 2,142 | 821 | 3,374 | 2,501 |
| ,, ,, | 1929 | 2,332 | 1,554 | 4,501 | 2,545 |

The propaganda work of the previous years is reflected in the steady increase of patients seeking treatment. But the problem of the defaulter—the patient who disappears after 3-4 injections for syphilis—is much less satisfactory. The difficulty is obvious—the patient considers himself cured and has a living to earn and considers further treatment a waste of time. The danger of relapse and the need for full treatment are always emphasised but, with coolie mentality, progress must be slow.

The number of cases treated at each of the clinics is shown below.

### PERAK.

| Centres. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| Ipoh Clinic | 3,209 | 1,090 | 198 | 4,497 |
| Ipoh Hospital | 523 | 180 | 46 | 749 |
| Taiping Clinic | 931 | 382 | 241 | 1,554 |
| Taiping Hospital | 323 | 176 | 199 | 698 |
| Kuala Kangsar, Women's Hospital | 157 | 331 | — | 488 |
| Kuala Kangsar, District Hospital | 296 | 148 | 104 | 548 |
| Batu Gajah Clinic | 339 | 127 | 83 | 549 |
| Batu Gajah Hospital | 323 | 128 | 23 | 474 |
| Kampar | 545 | 120 | 435 | 1,100 |
| Teluk Anson | 1,282 | 511 | 114 | 1,907 |
| Lenggong | 2 | 2 | 1 | 5 |
| Selama | — | 3 | 1 | 4 |
| Sitiawan | 25 | 2 | — | 27 |
| Parit | 91 | 8 | 2 | 101 |
| Kroh | 91 | 7 | — | 98 |
| Tanjong Malim | 236 | 104 | 4 | 344 |
| Sungkai | 150 | 16 | 4 | 170 |
| Tapah | 109 | 29 | 37 | 175 |
| Parit Buntar | 278 | 79 | 10 | 367 |
| Gopeng | 102 | 52 | 86 | 240 |
| Bagan Datoh | 44 | 12 | 5 | 61 |
| Grik | 107 | 3 | 2 | 112 |
| Klian Intan | 132 | 17 | 3 | 152 |
| Kuala Kurau | 90 | 2 | 5 | 97 |
| Central Mental Hospital | 287 | — | 2 | 289 |
| Bagan Serai | 272 | 34 | 17 | 323 |
| Total | 9,944 | 3,563 | 1,622 | 15,129 |

### SELANGOR.

| Centres. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| District Hospital, Kuala Lumpur | 1,347 | 477 | 97 | 1,921 |
| Sultan Street Clinic, Kuala Lumpur | 2,552 | 3,438 | 485 | 6,475 |
| Klang Clinic | 1,540 | 675 | 96 | 2,311 |
| Klang Hospital | 352 | 161 | 127 | 640 |
| Kajang | 857 | 121 | 16 | 994 |

## SELANGOR—(*cont.*).

| Centres. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| Kuala Selangor | 34 | 5 | 6 | 45 |
| Kuala Kubu | 498 | 172 | 98 | 768 |
| Serendah | 401 | 57 | 15 | 473 |
| Port Swettenham | 112 | 101 | 11 | 224 |
| Rawang | 260 | 54 | 31 | 345 |
| Rasa | 446 | 83 | 1 | 530 |
| Sungei Besi | 837 | 70 | 101 | 1,008 |
| Sepang | 174 | 69 | 99 | 342 |
| Telok Datoh | 86 | 58 | 15 | 159 |
| Federal Home | 28 | 34 | 2 | 64 |
| Total | 9,524 | 5,575 | 1,200 | 16,299 |

## NEGRI SEMBILAN.

| Centres. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| Seremban Clinic | 1,113 | 1,224 | 169 | 2,506 |
| Seremban Hospital | 327 | 168 | 43 | 538 |
| Mantin | 82 | 94 | 29 | 205 |
| Kuala Pilah, Women's Hospital | 174 | 58 | — | 232 |
| Kuala Pilah, District Hospital | 774 | 519 | 138 | 1,431 |
| Tampin | 1,105 | 362 | 43 | 1,510 |
| Rembau | 89 | 53 | 6 | 148 |
| Jelebu Clinic | 138 | 147 | 27 | 312 |
| Jelebu Hospital | 82 | 21 | 2 | 105 |
| Port Dickson | 300 | 220 | 69 | 589 |
| Gemas | 387 | 56 | 29 | 472 |
| Total | 4,571 | 2,922 | 555 | 8,048 |

## PAHANG.

| Centres. | Syphilis. | Gonorrhoea. | Soft Sore. | Total. |
|---|---|---|---|---|
| Kuala Lipis | 267 | 60 | 32 | 359 |
| Raub | 89 | 40 | 10 | 139 |
| Bentong | 332 | 40 | 4 | 376 |
| Kuantan | 115 | 128 | 28 | 271 |
| Mentakab | 93 | 18 | 10 | 121 |
| Pekan | 40 | 20 | — | 60 |
| Total | 936 | 306 | 84 | 1,326 |

## TREATMENT.

No outstanding changes in the treatment of venereal disease are to be reported. The course of treatment of syphilis is ten injections of arsenical and bismuth compounds, and two such courses are advised as routine.

During the year the average injection of Stabilarsan or N.A.B. has been increased from 0.3 grm to 0.45 grms and that of Bismostab from ½ cc to 1 cc. These increased doses will tend to lower the number of relapses.

## STAFF.

Dr. E. R. C. Cooke was confirmed in the appointment of Specialist, Venereal Diseases, on 1st September, 1929. The title was later changed to that of Chief Medical Officer, Social Hygiene, in conformity with the title in the Straits Settlements.

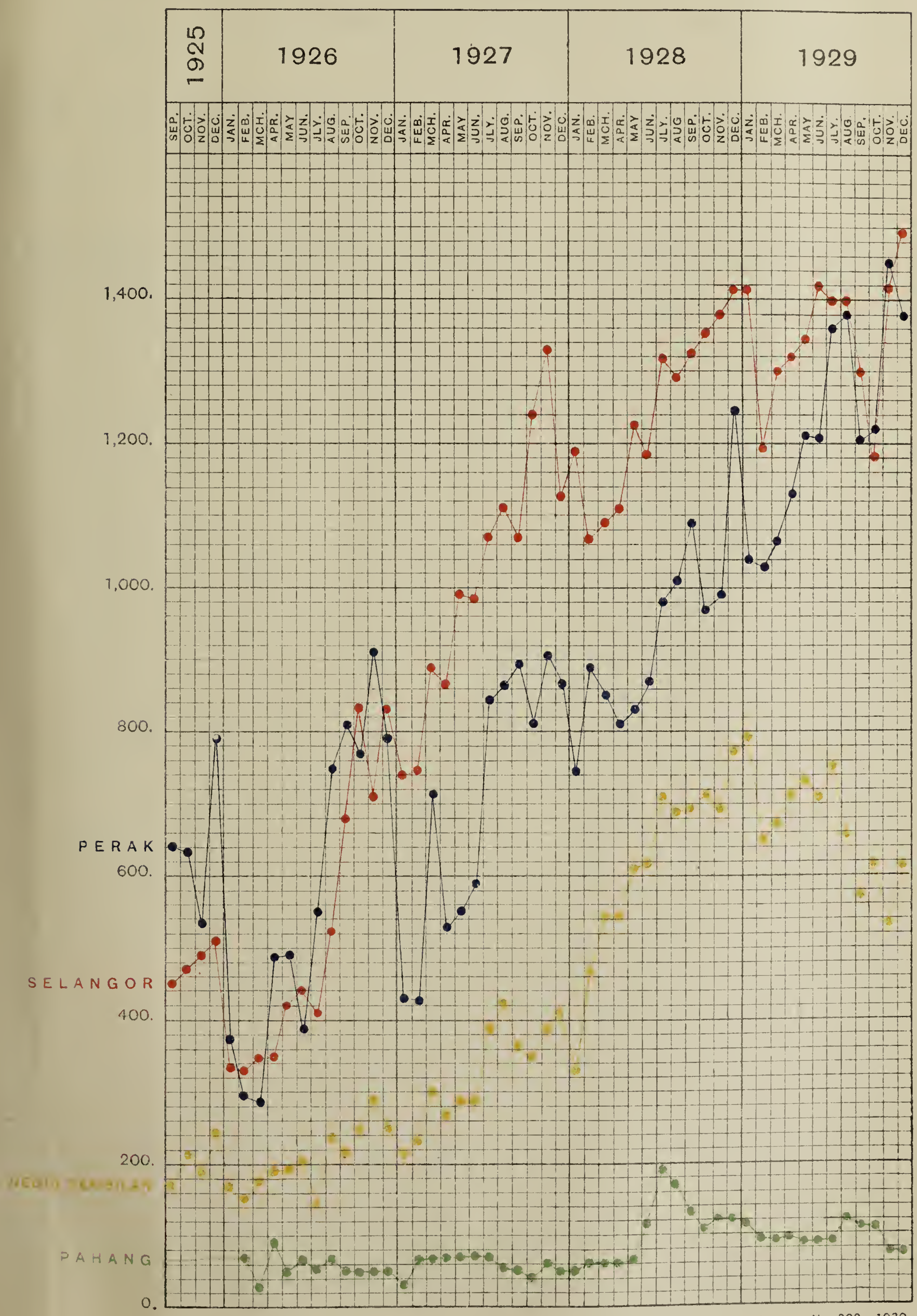
E. R. C. COOKE,
*Chief Medical Officer, Social Hygiene, F.M.S.*

## GRAPH NO. 1

## FEDERATED MALAY STATES

## VENEREAL DISEASES

## GRAPH SHOWING NUMBERS TREATED FROM SEPTEMBER 1925.



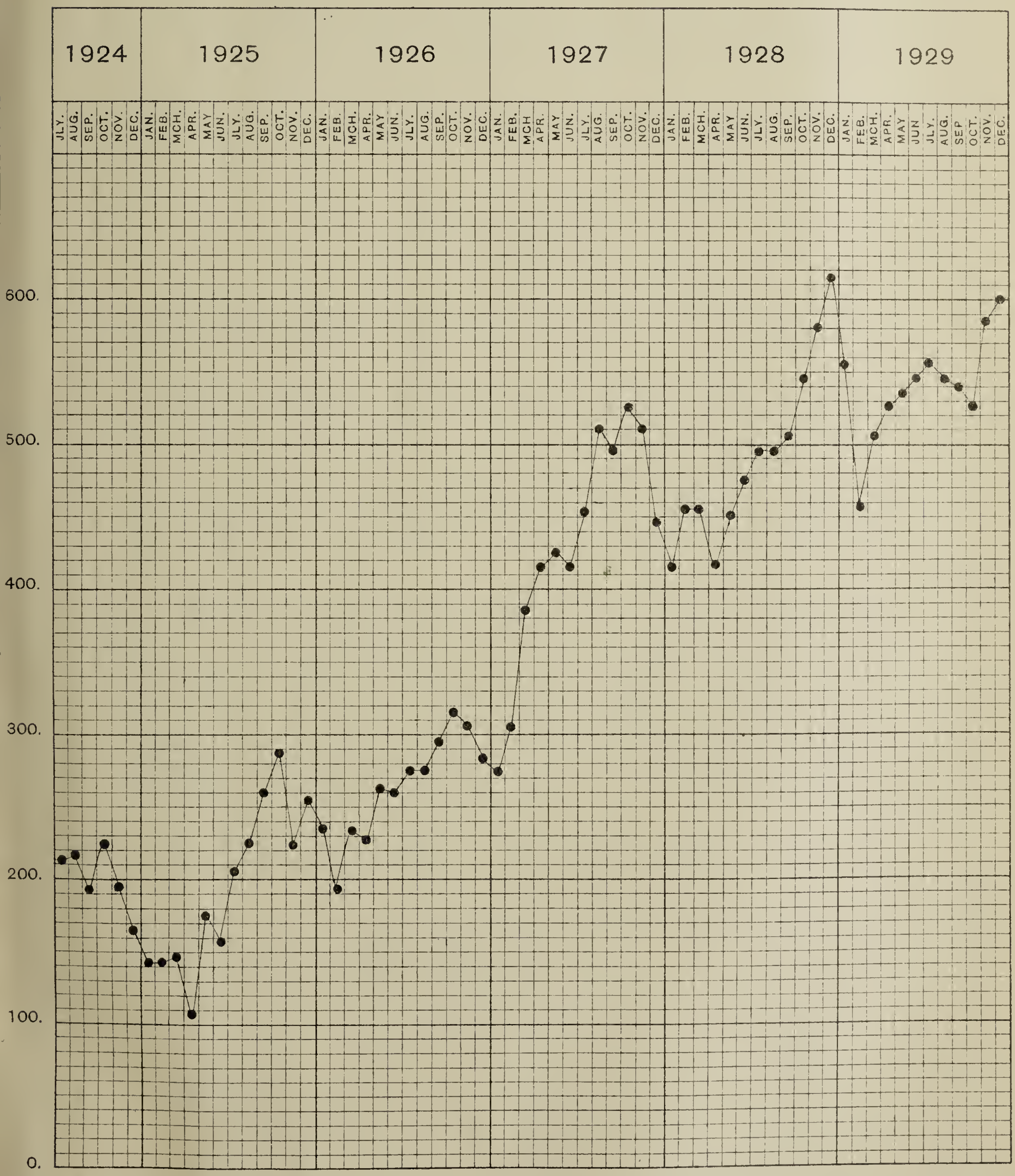
Drawn and Printed by F. M. S. Surveys No. 202 - 1930.

# GRAPH NO. 2

## SULTAN STREET VENEREAL DISEASE TREATMENT CENTRE

## KUALA LUMPUR

## GRAPH SHOWING ADMISSIONS FROM JULY 1924 TO DECEMBER 1929.



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## APPENDIX IV.

# REPORT ON VETERINARY BRANCH FOR THE YEAR 1929.

The veterinary service of the Federated Malay States remained under the control of the Medical Department throughout 1929, but in the near future will become a separate department upon the arrival of the newly appointed Principal Veterinary Officer. There is here submitted a summary of the reports of the Veterinary Surgeons from the four States. There was a Veterinary Surgeon, with subordinate staff, in charge of each of the following areas:

Perak North, Perak South, Selangor, Negri Sembilan, Pahang West and Pahang East.

## ANIMAL DISEASES.

### Foot and Mouth Disease.

There has been a large increase in the number of cases reported this year from each State except Pahang, 3,804 cases with 188 deaths having been reported, as against 555 with five deaths in 1928.

PERAK.—In Perak North, 261 cases occurred amongst cattle, with three deaths, in the Larut district, and 39 cases, with two deaths, in the Krian district; in Perak South the disease was of a mild type, and there was no mortality in the 241 cases.

SELANGOR.—There were two outbreaks amongst cattle and buffaloes at the Quarantine Station, Port Swettenham, in May, and again in November, involving 415 animals with six deaths, the disease being of a highly infectious type. Localised outbreaks also occurred in various districts of the State, 465 animals being affected, of which three died.

NEGRI SEMBILAN.—Until June the cases that occurred were of the usual mild type but the disease then broke out in the south with greatly increased virulence and severity, and despite all efforts spread, especially amongst buffaloes, proving the most serious outbreak the State has experienced for many years past. The death-rate was unprecedented, but fortunately this exalted severity did not long continue. During this time, however, 643 buffaloes and 511 cattle were affected, with 132 and 22 deaths respectively; from the middle of July the severity decreased and the disease rapidly assumed its normal mild type, cases occuring sporadically throughout the State and still being in existence near Bahau and Kuala Jelai at the end of the year. In all, 1,019 buffaloes with 149 deaths, 1,273 cattle with 25 deaths, and 23 sheep without mortality, were affected during the year.

The customary quarantine orders and restriction in the movement of cattle and buffaloes were enforced, and disinfectants issued. Encouraging results were obtained by adding potassium permanganate to the drinking water.

PAHANG.—In Pahang West there were six cases amongst buffaloes in June at Sungei Jerentut, and 62 amongst cattle in December, this outbreak continuing over to 1930. No case was reported in Pahang East.

The following table summarizes the cases:

| State. | Cases. | Deaths. | Destroyed. |
|---|---|---|---|
| Perak | 541 | 5 | 35 |
| Selangor | 880 | 9 | — |
| Negri Sembilan | 2,315 | 174 | — |
| Pahang | 68 | — | — |
| Total | 3,804 | 188 | 35 |

## Rinderpest.

This disease showed a considerable decrease, there being only 16 cases reported with five deaths, as against 285 with 193 deaths and 29 animals that had to be destroyed in 1928.

SELANGOR.—In May an outbreak occurred at the Port Swettenham Quarantine Station amongst cattle imported from India, two being affected, of which one was destroyed. A number of indirect contact Siamese buffaloes were immediately transferred to the Kuala Lumpur Quarantine Station; but four of these subsequently contracted this disease and died, providing a striking example of the high infectivity of the virus for the Siamese buffalo. Port Swettenham was closed to Indian cattle, and information was received towards the end of the year that rinderpest still prevailed in Negapatam Taluk, from which district Indian cattle are usually exported to Selangor.

PAHANG EAST.—In June an outbreak occurred amongst the draught oxen and milch herd of Bukit Uli, Kuantan, six being affected. All precautions were taken and the disease was confined to this herd. Five days later, 69 animals were inoculated with preventive serum received from Selangor. Nine cases occurred in all with no mortality, the animals making an uneventful recovery, though the majority showed the unmistakable skin lesions of this disease for a considerable period afterwards.

In the middle of July, a fresh case occurred which died eleven days afterwards; the herd was re-inoculated. No further case developed. It was impossible definitely to trace the origin of this outbreak, as apparently no new animal had been introduced into the kampong since the previous year, nor had the herd mixed with cattle other than those in the neighbourhood, none of which was affected. It is possible, since the cattle graze in the vicinity of the incinerator where slaughter house refuse is brought, that the infection arose from some remnant that had escaped incineration and acted as a reservoir of the virus.

SUMMARY.

| State. | Cases. | Deaths. | Destroyed. |
|---|---|---|---|
| Selangor | 6 | 4 | 1 |
| Pahang East | 10 | 1 | — |

No case was reported from Perak, Negri Sembilan, or Pahang West.

## Swine Fever.

PERAK.—In May there was an outbreak in a kampong at Tasek, Kroh. There were 93 cases, all of which died.

SELANGOR.—Seven cases were detected at the Kuala Lumpur abattoir and the animals were destroyed.

NEGRI SEMBILAN.—An outbreak occurred at Gemencheh and Batang Malaka in October involving 39 cases, of which 35 died and four were destroyed.

Another case developed in December and died.

PAHANG.—No case was reported from Pahang.

## Contagious Pleuro-Pneumonia.

PERAK SOUTH.—This disease developed amongst goats at Kampar in November. Ninety-eight cases occurred, of which 76 were slaughtered and 22 died.

## Rabies.

SELANGOR.—Canine rabies was prevalent during the year throughout the State with the exception of Ulu Selangor district. There were 48 cases distributed as follows:

| | |
|---|---|
| Kuala Lumpur | 25 (2 in unlicensed dogs) |
| Kuala Selangor | 13 (9 ,, ,, ) |
| Klang | 4 (1 ,, ,, ) |
| Kuala Langat | 4 (1 ,, ,, ) |
| Ulu Langat | 2 (1 ,, ,, ) |

In the Kuala Selangor district, two cases of bovine rabies occurred in calves. One dog definitely known to be bitten in June by a rabid animal was, at the owner's request, given a single large injection of canine anti-rabic vaccine 23 hours after the bite, the wound being cauterized with pure carbolic acid. The dog was kept thereafter confined to the owner's premises; seven months later it was fit and well. Since all dogs bitten by a rabid animal do not necessarily contract rabies, this experiment was no criterion of the efficacy of a single dose vaccine; but had the dog subsequently developed the disease, the single dose vaccine might definitely be suspected to be valueless if administered immediately after the infection of a bite.

It was decided that in 1930 compulsory prophylactic canine anti-rabic vaccination be given an intensive trial in Kuala Lumpur, and the necessary legislation was passed.

Negri Sembilan.—Five cases were reported, one of which had been vaccinated in 1928, and two of which were young puppies less than two months old.

No case was reported from Perak or Pahang.

### Haemorrhagic Septicaemia.

Perak South.—An outbreak occurred amongst buffaloes during December at Gunong Prai in Kinta; there were eight cases, all of which died.

Seventy-nine contact buffaloes were inoculated with specific anti-serum, and of these only three contracted infection, each within four days of inoculation.

### Surra.

Two dogs were discovered with this disease in Perak and were destroyed, one at Taiping and the other at Teluk Anson.

## VETERINARY QUARANTINE STATIONS.

Importation of animals through quarantine stations during the year was as follows:

Perak.—

| Cattle and buffaloes: | |
|---|---|
| Via Port Weld | 6,930 |
| Via Upper Perak | 547 |
| Via Parit Buntar | 73 |
| Via Selama | 224 |
| Via Teluk Anson | 1,109 |
| Via Padang Besar | 1,661 |
| | 10,544 |

Selangor.—

| | |
|---|---|
| Cattle and buffaloes | 6,014 |
| Sheep and goats | 12,901 |
| Dogs | 41 |
| Horses | 16 |
| Pigs | 25,438 |
| | 44,410 |

of which 18,774 were imported via Port Swettenham. Five thousand eight hundred and seventeen cattle were quarantined for ten days at Port Swettenham, and 635 cattle at Kuala Lumpur.

Negri Sembilan.—

| | |
|---|---|
| Cattle | 321 |
| Buffaloes | 241 |
| Sheep | 726 |
| Goats | 811 |
| Pigs | 148 |
| Dogs | 9 |
| Horses | 12 |
| | 2,268 |

All of these except the dogs and horses were imported for slaughter for food, and most of them arrived via other States.

Pahang.—

| | | |
|---|---|---|
| From Kelantan via Merapoh | 16 | buffaloes |
| Via Balok and Tanjong Api | 540 | oxen |
| ,, ,, ,, | 436 | buffaloes |
| Via Ports of Kuantan and Pekan | 3,410 | pigs |
| ,, ,, ,, | 49 | goats |
| ,, ,, ,, | 4 | horses |
| ,, ,, ,, | 1 | dog |
| ,, ,, ,, | 2 | monkeys |
| | 4,458 | |

## VETERINARY PROSECUTIONS.

| State. | Prosecutions. | Convictions. | Fines. |
|---|---|---|---|
| Perak | 455 | 417 | $3,754 |
| Selangor | 306 | 290 | 2,288 |
| Negri Sembilan | 190 | 184 | 1,357 |
| Pahang | 70 | 70 | 579 |

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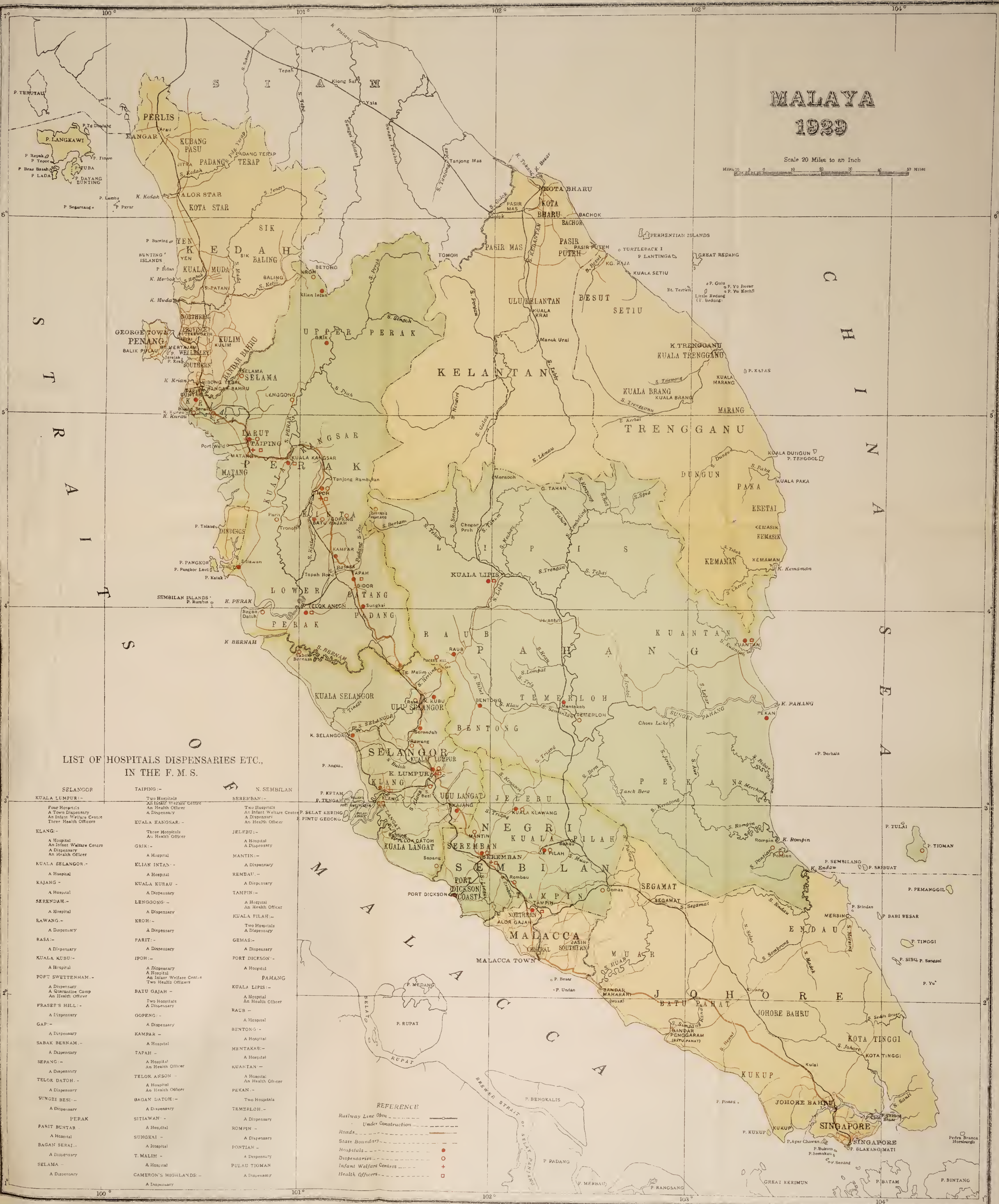
# MALAYA
# 1929

Scale 20 Miles to an Inch



## LIST OF HOSPITALS DISPENSARIES ETC., IN THE F. M. S.

### SELANGOR

KUALA LUMPUR:-

Four Hospitals
A Town Dispensary
An Infant Welfare Centre
Three Health Officers

KLANG:-

A Hospital
An Infant Welfare Centre
A Dispensary
An Health Officer

KUALA SELANGOR.-

A Hospital

KAJANG -

A Hospital

SERENDAH.-

A Hospital

RAWANG.-

A Dispensary

RASA:-

A Dispensary

KUALA KUBU:-

A Hospital

PORT SWETTENHAM.-

A Dispensary
A Quarantine Camp
An Health Officer

FRASER'S HILL:-

A Dispensary

GAP:-

A Dispensary

SABAK BERNAM.-

A Dispensary

SEPANG:-

A Dispensary

TELOK DATOH.-

A Dispensary

SUNGEI BESI.-

A Dispensary

### PERAK

PARIT BUNTAR -

A Hospital

BAGAN SERAI.-

A Dispensary

SELAMA -

A Dispensary

TAIPING:-

Two Hospitals
An Infant Welfare Centre
An Health Officer
A Dispensary

KUALA KANGSAR:-

Three Hospitals
An Health Officer

GRIK:-

A Hospital

KLIAN INTAN:-

A Hospital

KUALA KURAU -

A Dispensary

LENGGONG:-

A Dispensary

KROH:-

A Dispensary

PARIT:-

A Dispensary

IPOH:-

A Dispensary
A Hospital
An Infant Welfare Centre
Two Health Officers

BATU GAJAH -

Two Hospitals
A Dispensary

GOPENG:-

A Dispensary

KAMPAR -

A Hospital

TAPAH -

A Hospital
An Health Officer

TELOK ANSON -

A Hospital
An Health Officer

BAGAN DATOH:-

A Dispensary

SITIAWAN:-

A Hospital

SUNGKAI -

A Hospital

T. MALIM -

A Hospital

CAMERON'S HIGHLANDS:-

A Dispensary

### N. SEMBILAN

SEREMBAN:-

Two Hospitals
An Infant Welfare Centre
A Dispensary
An Health Officer

JELEBU:-

A Hospital
A Dispensary

MANTIN:-

A Dispensary

REMBAU.-

A Dispensary

TAMPIN:-

A Hospital
An Health Officer

KUALA PILAH:-

Two Hospitals
A Dispensary

GEMAS:-

A Dispensary

PORT DICKSON:-

A Hospital

### PAHANG

KUALA LIPIS:-

A Hospital
An Health Officer

RAUB -

A Hospital

BENTONG:-

A Hospital

MENTAKAB:-

A Hospital

KUANTAN:-

A Hospital
An Health Officer

PEKAN.-

Two Hospitals

TEMERLOH.-

A Dispensary

ROMPIN -

A Dispensary

PONTIAN -

A Dispensary

PULAU TIOMAN

A Dispensary

### REFERENCE

| | |
|---|---|
| *Railway Line Open* | |
| *Under Construction* | |
| *Roads* | |
| *State Boundary* | |
| *Hospitals* | ● |
| *Dispensaries* | ○ |
| *Infant Welfare Centres* | + |
| *Health Officers* | □ |

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